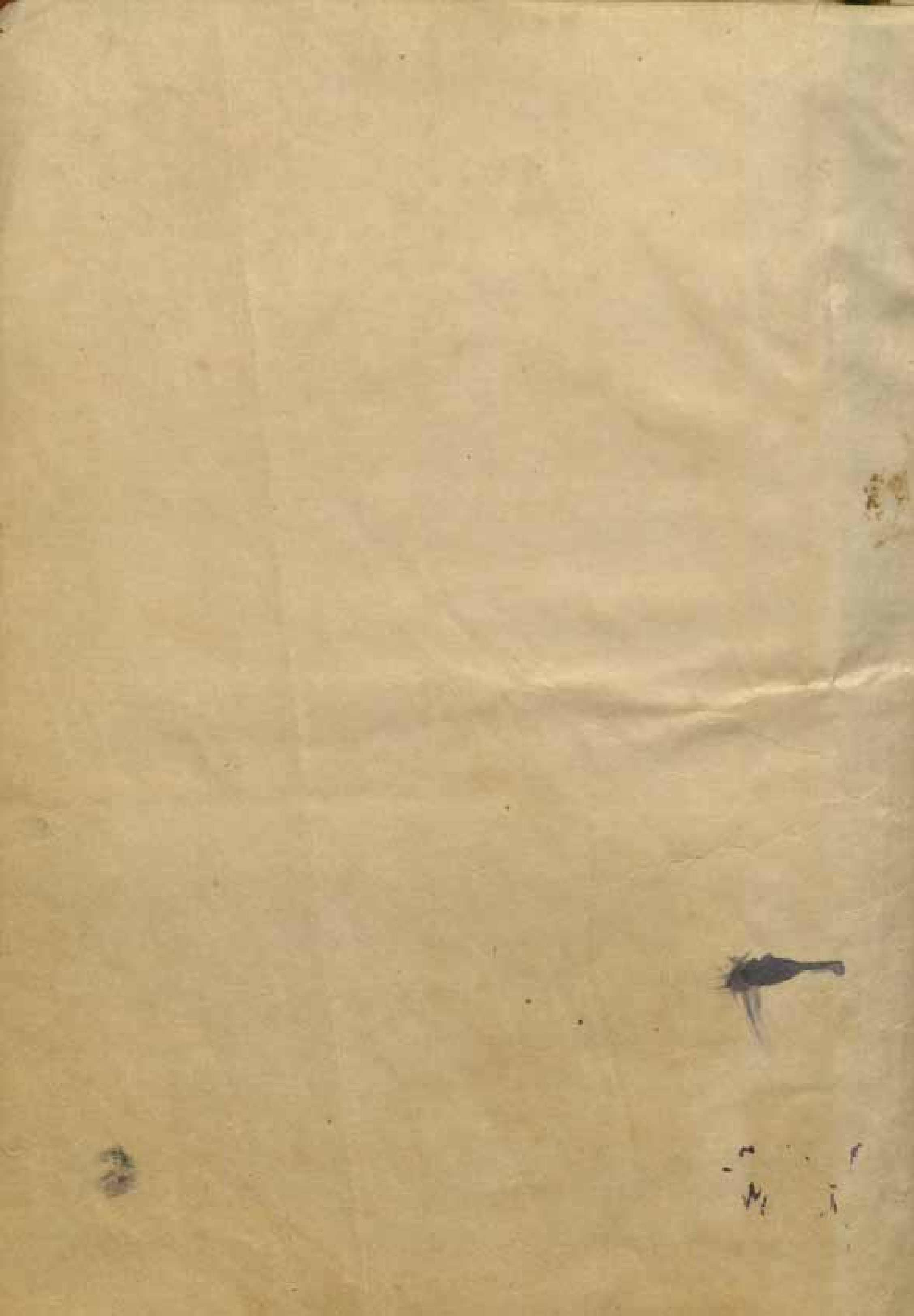
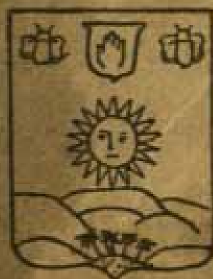


DECCAN COLLEGE
BUILDING CENTENARY AND SILVER JUBILEE SERIES
No. 32

Indian Prehistory : 1964

Editors

V. N. Misra and M. S. Mate



1965

GOVERNMENT OF INDIA

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INDIAN PREHISTORY : ~~1964~~

By
V. N. Misra
&
M. S. Mate

[Proceedings of the Seminar on Indian Prehistory and Protohistory, held at the University Department of Archaelogy, Deccan College, Poona, May 24—31, 1965.]

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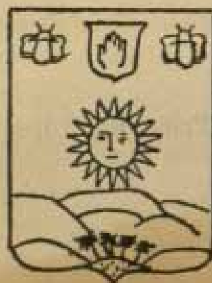


Editors

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FOREWORD

On the 15th of October 1964 the Deccan College celebrated the centenary of its main Building, and curiously enough this period coincides with the Silver Jubilee of the Postgraduate and Research Institute which, as successor to the Deccan College, started functioning from 17th August 1939 when members of the teaching faculty reported on duty. When I suggested to members of our faculty the novel idea that the centenary should be celebrated by the publication of a hundred monographs representing the research carried on under the auspices of the Deccan College in its several departments they readily accepted the suggestion. These contributions are from present and past faculty members and research scholars of the Deccan College, giving a cross-section of the manifold research that it has sponsored during the past twentyfive years. From small beginnings in 1939 the Deccan College has now grown into a well developed and developing Research Institute and become a national centre in so far as Linguistics, Archaeology and Ancient Indian History and Anthropology and Sociology are concerned. Its international status is attested by the location of the Indian Institute of German Studies (jointly sponsored by Deccan College and the Goethe Institute of Munich), the American Institute of Indian Studies and a branch of the Ecole Francaise d'Extreme-Orient in the campus of the Deccan College. The century of monographs not only symbolises the centenary of the original building and the Silver Jubilee of the Research Institute, but also the new spirit of critical inquiry and the promise of more to come.

S. M. Katre

PREFACE

Current problems of Indian archaeology, particularly relating to certain aspects of prehistory and protohistory, have been discussed for the last ten years or so at the annual meetings of the Central Advisory Board of Archaeology. These discussions have two limitations: First they are open only to the field workers who happen to be present at these meetings. Secondly, the time at the disposal for discussion is also very much restricted. Hence we all felt the need for an occasion to discuss some of the important problems of Indian prehistory and protohistory.

Such an opportunity was provided by the University Grants Commission. Under their enlightened policy, universities in India are encouraged to hold summer and winter schools, seminars and symposia. Under one such project, the Department of Archaeology, University of Poona, located at the Deccan College Postgaduate and Research Institute, held a Seminar in prehistory and protohistory of India from 24th to 31st May, 1965.

This Seminar had three main aims:

(1) To discuss a few important problems in prehistory and protohistory created by intensive work in these two fields of archaeology during the last 15 years or so;

2. To bring together the scholars—young and old—senior or junior—working in this field, irrespective of their status, so that the latest data can be freely discussed, problems redefined and attempts made to face them.

(3) The third objective was to place before the scholars at large the latest happenings in Indian prehistory and protohistory. For it would appear that excepting a few scholars in Russia, scholars elsewhere do not care to acquaint themselves with Indian publications and hence theories and views decades old are "dished out" to the world in publications which claim to speak on world prehistory. It is hoped that the publication of the proceedings of the seminar would help to remove this deliberate neglect of Indian prehistory.

With a view to making our discussions purposeful three precautions were taken.

As there was not much time for previous consultation among colleagues in other parts of India regarding the themes to be discussed at the seminar, and the persons to be invited, for participating in various capacities, the themes chosen were not very specific, but broad, so that we could attack them from different points of view.

Secondly, only those scholars were invited to participate in the seminar who either as field workers or organizers or authors had intimate first-hand knowledge of the subjects selected for discussion.

From among these scholars, a panel of scholars was prepared and each scholar was requested to prepare a working paper on a chosen theme.

A deliberate attempt was made to associate at least one research student from each of the universities which have a department of Archaeology.

The papers were then cyclostyled and circulated among the various participants and comments were invited from them. Thus when we met at the seminar, discussions were kept fairly well within the prescribed limits, though an opportunity was also given to others who were not among the selected participants for expressing their opinion on the topics under discussion.

On the whole the proceedings went off well. But for the gloom cast by our late Prime Minister's sudden death, which prevented discussion of the topics "Traditional Indian chronology and C-14 dates of Excavated sites" and "Archaeology and Education", other topics were discussed with great animation. Had we a little more time for the circulation of the working papers and the time for receiving comments from the participants, all those gathered would have profited much more.

The organization of the seminar was made possible by the co-operation offered by Shri A. Ghosh, the Director General of Archaeological Survey of India and several of his officers. We had to draw heavily upon their talent, for no seminar in archaeology in India can be visualized without their full co-operation. The universities of Aligarh, Allahabad, Baroda, Banaras, Calcutta, Madras and Saugar also responded splendidly; so also the State Departments of Gujarat, Rajasthan and Mysore.

At "home" all the members of our Faculty including the office staff and peons had to work hard for a period of two months and more. If any success we achieved in this, it was because of willing and spontaneous assistance rendered in various ways by every one of them.

As there was no arrangement for tape-recording the proceedings, the various participants in the Seminar were requested to write out their comments. These comments, inspite of written instructions, went very much beyond the actual "speech" at the seminar. All such comments had to be severely edited. And this work was entrusted to Dr. V. N. Misra who has carried out a most unenviable task very conscientiously. He also went through the proofs. Dr. M. S. Mate helped him in preparing the text for the press and seeing the proofs.

The discussions in the seminar have no doubt clarified our minds regarding a number of problems, though we have not solved any. But this is not expected of any discussion. The solution lies in planned work indicated during the discussions.

Already action has been taken as a result of the discussion on the Narmada stratigraphy. A joint expedition organized by the Archaeological Survey of India and the Deccan College carried out a preliminary survey of the upper reaches of the river between Amarkantak and Hoshangabad as a part of a five-year project and a fresh excavation was carried out in the gravels at the site of Mahadeo Piparia in Narsinghpur District in M. P. by Shri S. G. Supekar of the Institute.

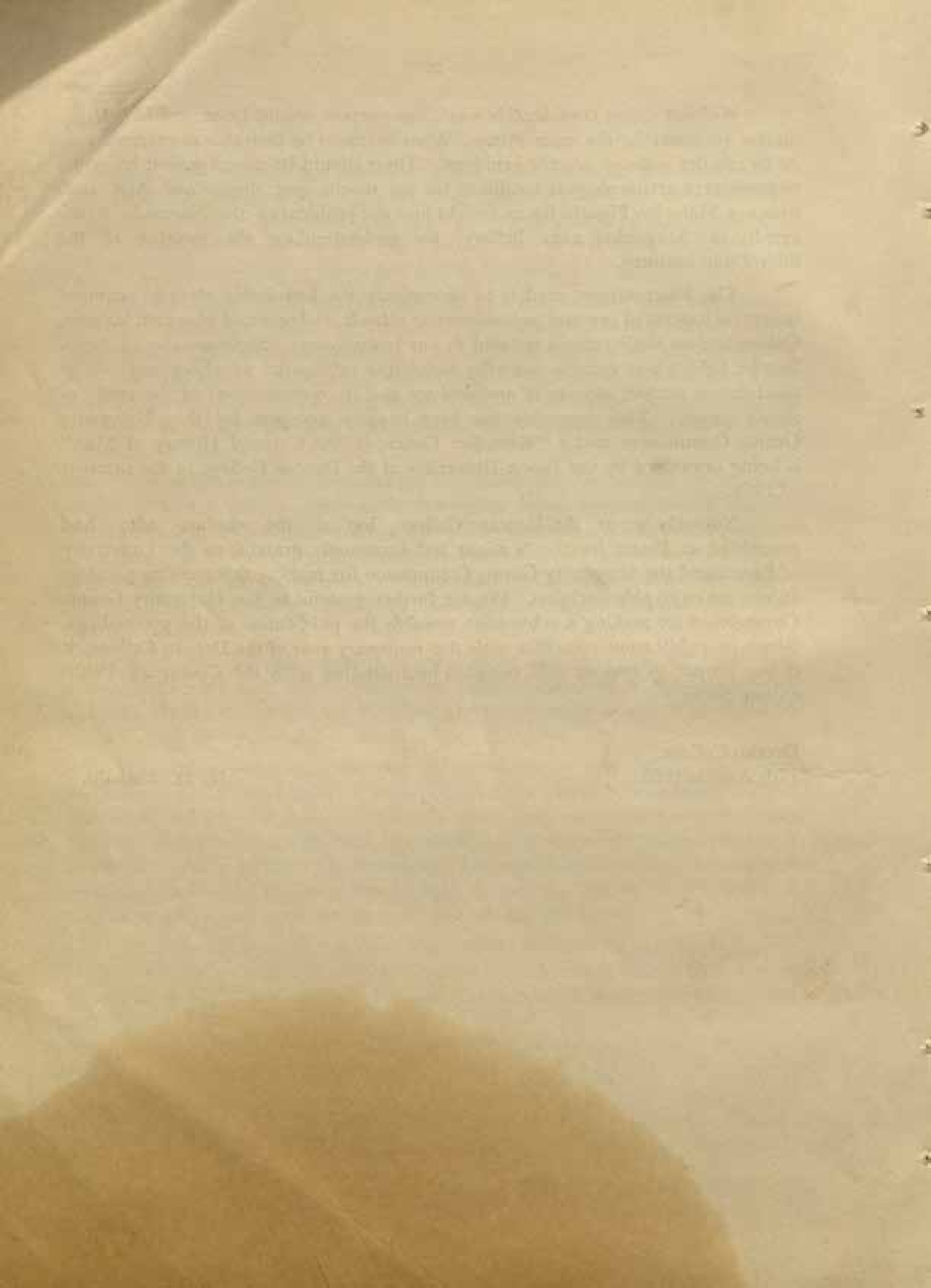
Without doing considerable work, no purpose would be served in holding similar seminars in the near future. What seems to be desirable are seminars on much smaller scale on specific problems. These should be accompanied by visits to important archaeological localities for an on-the-spot discussion. And such sites are Mahadeo Piparia for an insight into the problem of the Narmada stratigraphy and Sangankal, near Bellary, for understanding the position of the microlithic industry.

The other urgent need is to disseminate the knowledge already acquired in several aspects of pre and protohistory to schools, colleges and educated laymen. Otherwise, we shall remain isolated in our ivory towers. Seminars should therefore be held where experts can offer something substantial to school and college teachers on various aspects of archaeology and its contributions to the study of man's history. This suggestion has been happily accepted by the University Grants Commission and a "Refresher Course in the Cultural History of Man" is being organized by the Poona University at the Deccan College in the summer of 1966.

Not only we at the Deccan College, but all the scholars who had assembled at Poona for the Seminar feel immensely grateful to the University of Poona and the University Grants Commission for making this meeting possible. It was an enjoyable occasion. We are further grateful to the University Grants Commission for making a subvention towards the publication of the proceedings. Since its publication coincides with the centenary year of the Deccan College, it is but proper to honour this occasion by including it in the Centenary Publication Series.

Deccan College,
17th August 1965.

H. D. Sankalia



EDITORS' NOTE

It was originally planned to record verbatim proceedings of the Seminar and to publish them as such. However, since it could not be arranged for various reasons, the next best course was adopted. Some of the participants had sent in their written comments before the seminar actually began; others made their comments during the discussion. In the discussions during the various sessions several new points emerged and hence an opportunity was given to all the participants to check the matter they were contributing. The Convenors were next requested to recheck the entire proceedings of their session before the press-copy was finally prepared. Wherever it was thought that unnecessary duplications occurred even after this, the editors had to prune the texts. We take this opportunity to thank the various participants and more especially the Convenors who have helped us in bringing as much accuracy as possible in the report.

The press copy was very neatly typed by Shri P. S. Mujumdar of the Deccan College. The Manager of the Lokasangraha Press, Poona has printed the Proceedings very neatly and expeditiously. We are thankful to them.

Last but not the least we have to express our gratitude to Prof. H. D. Sankalia whose valuable guidance enabled us to edit the Proceedings with expedition.

Deccan College
17th August 1965

V. N. Misra
M. S. Mate

PROCEEDINGS

Seminar on Prehistory and Protohistory of India 24th—31st May, 1964, at the Poona University Department of Archaeology, Deccan College, Poona, India.

Sponsored by University Grants Commission, New Delhi.
Organising Director, Hasmukh D. Sankalia; Deccan College, Poona
Secretary, V. N. Misra, Poona University, Deccan College, Poona.

1. Chairman K. V. Soundara Rajan
   Is Soan a Separate Culture?
   (25th May 1964, Morning Session)
2. Chairman A. P. Khatri
   Some Problems Concerning Pleistocene Stratigraphy of India with Remarks on Pollen Stratigraphy
   (25th May 1964, Afternoon Session)
3. Chairman H. D. Sankalia
   Middle Stone Age Cultures in India and Pakistan
   (26th May 1964, Morning Session)
4. Chairman V. N. Misra
   Mesolithic Phase in the Prehistory of India.
   (26th May 1964, Afternoon session)
5. Chairman B. K. Thapar
   Neolithic Problem in India
   (27th May 1964, Morning session)
6. Chairman A. Ghosh
   The Indus Civilization : Its Origins, Authors, Extent and Chronology.
   (29th May 1964, Morning session)
7. Chairman B. K. Thapar
   Relationship of Indian Chalcolithic Cultures with West Asia.
   (29th May 1964, Afternoon session)
8. Chairman N. R. Banerjee
   Iron Age in India
   (30th May 1964, Morning session)
9. Chairman B. B. Lal
   Soils as Environmental and Chronological Tools.
   (30th May, Afternoon session)
10. Plenary session, 30th May 1964, evening.

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LIST OF DELEGATES

1. D. P. Agrawal,
   Tata Institute of Fundamental Research,
   Bombay.
2. R. C. Agrawal,
   State Department of Archaeology,
   Udaipur.
3. Z. D. Ansari,
   Deccan College,
   Poona-6.
4. K. D. Banerjee,
   Archaeological Survey of India,
   Nagpur.
5. N. R. Banerjee,
   Archaeological Survey of India,
   Agra.
6. M. N. Deshpande,
   Archaeological Survey of India,
   Dehra Dun.
7. M. A. Dhaky,
   State Department of Archaeology,
   Rajkot.
8. M. K. Dhavalikar,
   Archaeological Survey of India,
   New Delhi.
9. M. G. Dikshit,
   Nagpur University,
   Nagpur.
10. R. C. Gaur,
    Aligarh Muslim University,
    Aligarh.
11. A. Ghosh,
    Archaeological Survey of India,
    New Delhi.
12. A. K. Ghosh,
    University of Calcutta,
    Calcutta.
13. Mrs. S. L. Gokhale,
    Poona University,
    Deccan College,
    Poona.
14. S. P. Gupta,
    National Museum,
    New Delhi,
15. K. T. M. Hegde,
    M. S. University,
    Baroda.
16. N. Isaac,
    Christian College,
    Guntur.
17. R. V. Joshi,*
    Archaeological Survey of India,
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18. Mrs. G. Karve—Corvinus,
    Deccan College,
    Poona.
19. Kenneth, A. R. Kennedy,
    University of California,
    Berkeley.
20. A. P. Khatri,
    Council of Scientific & Industrial Research,
    New Delhi.
21. B. B. Lal,
    Archaeological Survey of India
    Dehra Dun.
22. M. S. Mate,
    Deccan College,
    Poona.
23. R. N. Mehta,
    M. S. University,
    Baroda.
24. V. N. Misra,
    Poona University,
    Deccan College,
    Poona.
25. G. C. Mohapatra,
    Punjab University,
    Chandigarh.
26. G. G. Mujumdar,
    Poona University,
    Deccan College, Poona.

27. P. C. Pant,
Banaras Hindu University,
Varanasi.
28. S. N. Rajguru,
Deccan College,
Poona.
29. B. K. Gururaja Rao,
Madras University,
Madras.
30. S. R. Rao,
Archaeological Survey of India,
Madras.
31. H. D. Sankalia,
Deccan College,
Poona.
32. D. Sen,*
Calcutta University,
Calcutta.
33. G. R. Sharma,*
Allahabad University,
Allahabad.
34. Y. D. Sharma,
Archaeological Survey of India,
New Delhi.
35. U. V. Singh,
University of Saugar,
Saugar.
36. K. V. Soundara Rajan,
Archaeological Survey of India,
Madras.
37. B. K. Thapar,
Archaeological Survey of India,
Nagpur.
38. R. K. Varma,
University of Allahabad,
Allahabad.
39. Vishnu-Mittre,*
Birbal Sahni Institute of Palaeo-botany,
Lucknow.
40. V. S. Wakankar,
Bharat Kala Bhavan, Ujjain.

*Did not attend the Seminar but had sent their papers.

LIST OF STUDENTS DELEGATES

1. Miss K. N. Frenchman,
Deccan College,
Poona.
2. G. C. Jain,
Saugar University,
Saugar.
3. Dhyaneshwar Mandal,
Allahabad University,
Allahabad.
4. R. S. Mishra,
Banaras Hindu University,
Varanasi.
5. K. Murthy,
Deccan College,
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6. T. Seetharama Murthy,
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7. S. Nagabhushan Rao,
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Poona.
8. M. S. Nagaraja Rao,
Deccan College,
Poona.
9. S. Nagaraju,
Deccan College,
Poona.
10. Miss Malti Nagar,
Deccan College,
Poona.
11. Nisar Ahamad,
Deccan College,
Poona.
12. K. Paddayya,
Deccan College,
Poona.
13. R. S. Pappu,
Deccan College,
Poona.
14. Amba Lal Patel,
M. S. University,
Baroda.
15. S. G. Supekar,
Deccan College,
Poona.
16. A. Swamy,
Madras University,
Madras.

INDIAN PREHISTORY : 1964

[Proceedings of the Seminar on Indian Prehistory and Protohistory, held at the University Department of Archaeology, Deccan College, Poona, May 24–31, 1965.]

IS 'SOAN' A SEPARATE CULTURE ?

K. V. Soundara Rajan

The relationship that Soan evolution in tool development has with climatic fluctuations in the Pleistocene has been brought out by the Yale-Cambridge expedition (De Terra and Paterson, 1939).

The geographical ambit of the Soan culture is said to link it with S. E. Asia (Movius, 1948).

The occurrence of Soan tool culture on the Siwaliks (India) with a terrace sequence that at least morphologically appears to have a reasonable parallel with Potwar (W. Pakistan) has been indicated by work in Nalagarh and Kangra valley (Sen, 1955; Lal, 1956).

A culture should be the sum total of more than one industry or a group of techniques set in an evolving, socio-material matrix. The Soan culture, on this count, would seem to fall short of the definitional scope and would, at best, seem to be an industry displaying the rise, perfection, and degeneration of the 'prepared platform technique'. But when we say Soan culture, we take into account not merely the entire range and devolution of the tool outfit, but also the society or the community of men, howsoever disparate or gregarious in unit, who forged this artifice-making potentiality to material and mundane purposes. The Soan by its very typical typological character is certainly an entity by itself and should thus be eligible to be called a 'culture'. But the more pertinent question may perhaps be whether the Soan entered the main stream of the Indian Early Stone Age, and had any fruitful integration with it and made further temporal contributions to the sum total of the Palaeolithic of the Peninsula and extra-Peninsula. It is here that recent scrutiny would seem to reveal clearly that Soan did not have any key role to play in the Cis-Sutlej Indo-Gangetic plains on the uplands of Rajasthan, the Vindhyas, the Deccan and the South. It would appear to have been—to borrow with a limited scope and connotation from Social Anthropology—an essentially endogamous group, whereas the Great Peninsular Stone tool culture, popularly called the Madrasian handaxe culture, would seem to have a fullness of evolution and diffusionary manifestation over the entire India, not excluding even the Potwar as seen in T³ at Chauntra. Thus, the time seems to have arrived when we should come to grips with the severely delimited and circumscribed character of the Soan culture, how it has its filliations mainly with the trans-Sutlej glacial chronology, how it is an essentially mono-technical tool-outfit, and how it failed to commingle with the evolving Stone Age India. The Soan and the Great Peninsular Handaxe culture appear to have met at Potwar itself, as opined by De Terra, in the II Interglacial, and no corresponding osmosis appears to have taken place in the more southern regions of Gujarat and Central India, as held for quite some time by earlier workers.

In short, if the Early and Middle Stone Age manifestations of the Indian Stone Age were truly national in compass and technological criteria, the Soan is essentially a regional and a highly specialised culture of, perhaps, a severely individualistic society, and like similar specializations in organic evolution, it lost its nexus with the rest of India and failed to be integrated with it and became degenerate and extinct, and at best mixed with the Indian prehistoric culture only in Late Stone Age in Holocene T^5 of Potwar.

Early Soan, Late Soan and T^3 would thus mainly correspond to Early, Middle and Late Stone Ages, but the mosaic is apparent in the latter, the former being etched out only in cultural monotones.

In such a circumscribed zone of influence of the Soan is clearly to be visualised the ethnic varia of Stone Age India, although at present we do not have skeletal remains to sustain such a viewpoint.

D. Sen :

The So-called Pre-Soan flake industry found in the Boulder Conglomerate of Second Glacial stage in West Punjab has not been studied in the light of its probable genetic or evolutionary relationship with the succeeding Early Soan industry or the Abbevillio-Acheulia industry of the following Second Interglacial. Yet the scope and distribution of its flake typology need to be more fully followed up and further ground covered. Also, in view of the wide-spread occurrence of the pluvial Boulder Conglomerate deposits in the south having yielded a mixed crop of artefactual data, it would be worthwhile to explore intensively the glacifluvial Boulder Conglomerate in the Punjab for further artefactual and environmental data.

With the reservations outlined above, the Soan culture should be primarily viewed in the perspective of its recurrent assemblage of integrated traits (within dated geological and environmental contexts) and its pattern of distribution. In its early phases (Early Soan) dated within the Mid-Pleistocene warm Second Interglacial stage, the Soan reveals a recurrent assemblage of three distinct interlocking traits as follows :—

(i) Pebble tools, comprising unifacial and bifacial choppers (chopper and chopping tools of Movius) made on small to medium light-coloured quartzite pebbles, mostly oval, round or flat-based forms. In some respects these typologically recall the Kafuan-Oldowan of Africa.

(ii) Pebble-cores, inculding mostly the oval and discoidal forms, the last somewhat resembling the Clactonian and proto-Levolloisian.

and (iii) Flakes, comprising (a) wide-angled unfaceted types.
(b) low-angled simple faceted types.

The first trait in the assemblage is more dominant than the other two traits. Typologically in some respects, the above assemblage of integrated traits recalls the Choukoutenian and Early Anyathian. The handaxe is conspicuous by its absence in this assemblage.

Geographically, the habitat of the Early Soan comprises the high periglacial terraces of the Indus-Soan-Jhelum valleys of West Punjab (W. Pakistan) and the

Sutlej-Sirsa and Beas-Banganga valleys of East Punjab (India). Further explorations in the plains of upper India may reveal an extension of this geographical pattern. This is a fruitful area and is worth following up. The occurrence, if any, of the handaxe industry and/or of a basic industrial stage of the evolution of the handaxe should be geologically founded.

In West Punjab, during the same period viz. the long Second Interglacial stage, in the high river-terraces (T_1) near Rawalpindi and elsewhere (Adiala and Chakri), an Abbevillio-Acheulian complex consisting of handaxes, cleavers, choppers, cores and flakes has been traced. But no site or industry, dated within the Second Interglacial, has yet been traced revealing any clear contact of the two lithic complexes. In East Punjab, the river terraces, which have revealed Early Soan assemblages, are so far conspicuously devoid of the *true* biface, though a few examples of the so-called proto-types of the handaxe (?) made on pebble have been reported (Pebble-butted unifacial or partly bifacial pointed tools characterized by few 3-4 directional primary flake-scars). With the data at hand, the handaxe cannot be considered as an integrated trait of the Early Soan. At least at the present stage of field research, we cannot establish any genetic connection between any trait-complex of the Early Soan and the biface complex during the Second Interglacial. On the other hand, it is likely that during a climatic crisis the handaxe from the tropical south (which undeniably is its true habitat) gradually shifted over to the northern plains and may have had made an external contact with the Early Soan towards the *end* of the Second Interglacial period in the Punjab. The two lithic complexes coexisted at certain places for sometime during the Second Interglacial, apparently without one influencing the other. Possibly, however, during the Mid-Pleistocene to Upper Pleistocene changeover during a phase of climatic crisis, the two lithic complexes came to be mixed at certain localities. The Upper Pleistocene which followed was a period of cultural flux as is evidenced by mixed or hybrid ndustries in the Punjab as elsewhere in India.

It is interesting to note that unifacial and bifacial pebble-choppers during the Mid-Pleistocene Second Interglacial stage in the West Punjab occur in a dual industrial context:

(i) with the flakes (Early Soan)

(ii) with the biface (Abbevillian)

In the context of their occurrence with the flakes, the pebble choppers constitute a dominant inherent trait of the Early Soan complex along with flakes during the Second Interglacial. But later in the Third Glacial and the following Interglacial, the trait gradually lost its importance particularly with the coming of the Levalloisian and the Acheulian.

In the context of its occurrence with the biface in the Punjab and particularly in Peninsular India, it is clear that it is a trait (though not dominant) of the biface culture of India. In the latter stages of the biface development (Acheulian), it gradually lost its importance.

From its wide geographical distribution and from its pattern of occurrence with divergent trait-complexes in India and Pakistan as well as in other parts of Asia, it may be inferred that this tool-making trait (pebble choppers) of Early Man was probably the most primitive in this part of the Old World. But this must be confirmed by geological and palaeontological data.

No site nor any basic stratum has yet been found in India or Pakistan showing the exclusive occurrence of crude pebble tools only, or of biface or flakes only. They occur rather in *group complexes* as has been described above. This group complex with emphasis on flakes characterizes the Soan from that of the biface. It must, however, be admitted that the Punjab plains of West Pakistan have not been extensively explored for *in situ* artifacts. We are still at large about the nature of the earliest artefactual data. Though the Early Soan shows a dominance of pebble-tool types (like the choppers) and appropriate cores over the associated flakes (which are themselves derived from pebble cores), a developmental trend among the flakes only is observed. The pebble tools, on the other hand, do not reveal any marked technical development, though in the Late Soan assemblage they are smaller and neater. Yet in a suitable context, perhaps under the influence of appropriate ecological factors, large pebble choppers (or their like) may have had techno-typologically contributed towards the development of the Abbevillian type of the handaxe in Peninsular India. Crude Abbevillian type of handaxes with large pebble-butts are found in mixed assemblages in many localities. No such development can yet be proved in the Punjab with the field-data at hand. No exclusive or earlier stratum containing pebble tools only has yet been traced in Peninsular India like that of the Olduvai Gorge in East Africa. It is, however, now necessary to undertake a comparative technical study of the Early Soan pebble choppers of the Punjab and the pebble choppers found associated with the Handaxe in the Punjab and in Peninsular India.

The lithicultural pattern is distinctively different with the advent of the cold Third Glacial stage of the Upper Pleistocene, when the Early Soan pebble tools and flakes were gradually replaced by neater and smaller pebble tools (without marked technical development) and more evolved flakes of Levalloisian types constituting the Late Soan A industry. Numerically the flakes and their cores outnumber the pebble tools in this industry and on this statistical concept, it may be described as a flake industry. The second phase of the Late Soan culture, viz. Late Soan B industry of Late Third Glacial as well as the Evolved Soan of the Third Interglacial stage reveal in the main lithic assemblages of Levallois-Mousteroid types of flakes and appropriate cores.

This typical assemblage of the Late Soan repeatedly occurs over a wide but well-defined area in W. Punjab. Apart from this, but more significantly, a few sites like Chauntra and Gariala have revealed hybrid industries containing Middle to Upper Acheulian types of handaxes and cleavers and Late Soan flake industry. More intensive explorations are likely to reveal further sites of mixed or hybrid industries. Here among the biface, both Acheulian and the step-flaking techniques (the latter recalling the Levalloisian) are discernible.

Thus during the Third Glacial phase of Upper Pleistocene times in W. Punjab so far at certain localities-the Soan and the Acheulian apparently came in contact when flake tools of Soan-Levalloisian type and Middle Acheulian type of the handaxe and the cleaver were fabricated simultaneously. It is possible that the Abbevellio-Acheulian complex which appeared during the Second Interglacial of Middle Pleistocene period in the Punjab overlapped with the emerging Late Soan artefactual assemblage during a critical phase of climatic change. It is not surprising that the two complexes would mix in the context of changing climate, migration and cultural adaptation.

Our main observations on the Late Soan are that (I) the habitat of the Late Soan culture is the periglacial plains of W. Punjab, (ii) the Late Soan has in the main evolved from an earlier pebble-and-flake culture, (iii) it is essentially a flake culture of Levallois-mousteroid complex (multifaceted (police-hat) triangular points recalling the classical Mousterian occur in the Late Soan assemblage) and finally that (iv) it is overlapped with the Acheulian producing a culture-complex which may be technically described as Soan-Levallois-Acheulian. In this culture-complex, the Soan-Levallois elements appear to be dominant. Presumably as a result of this contact, the Acheulian element (the handaxe) shows a step-flaking technique. A statistical analysis of each assemblage expressed in a frequency diagram should enable us to define the assemblage more specifically. But numerically large data are required for this purpose.

To sum up our short review of the Soan culture as a whole, we observed that in its earlier phases, it reveals a crude technology based on primitive pebble tools, cores and flakes. The flakes recall the Clactonian and proto-Levalloisian techniques. Among the pebble-tools which are mostly of the chopper type, there are a few examples of pebble-butted, partly-bifacial pointed tools. Contemporary with this assemblage, a lithic complex of Abbevillio-Acheulian types is also present. But no clear contact between the two complexes is yet established though presumably the two may have mixed laterly. Thus the Late Soan appears to be a mixed assemblage revealing in the main flake tools and biface based on the Levalloisian and Acheulian techniques (both core and flakes), with emphasis on the former, coupled with pebble tools[1]. This lithic complex may be described as Soan-Levallois-Acheulian. Where the Acheulian element is absent or rare as in some Late Soan sites, the lithic complex there may be described as Soan-Levalloisian.

The picture that emerges is, however, far from complete or clear and only intensive research and further discoveries in Pakistan may bring out more clearly the technical inter-relations of the trait complexes.

R. V. Joshi :

All our discussion on the Stone Age material from the Soan is based mainly on the reports published by De Terra and Movius. For direct scrutiny of the tools we have only a small collection at Calcutta. The details as regards the find spots and terrace levels given on these specimens are, however, not clear and it is not at all a representative collection. A sizable collection of these specimens is

available at Cambridge and at least a few of us must have had the occasion to examine it. Those who have seen the total or larger collections of palaeoliths from various sites in Peninsular India will be convinced that the handaxe culture is varied both in tool-types and the proportion of each tool-type. Thus in areas where pebbles are abundant in the total or sizable collections, the chopper-group is very dominant. This tool-type includes all unifacial and bifacial chopper-type implements. We also know that this mixed tool assemblage occurs only in one horizon and technologically it is inseparable from the other. The predominance of certain tool-types thus seems to be an ecological factor dependant on environment.

Considering De Terra's presentation of morphology and archaeology of the Soan valley it must be said that although he has taken much pains in detailing the geomorphic aspects of the Kashmir and the Potwar region his treatment of the tool collections is not very satisfactory. References may be quoted where he himself states that the handaxe implements are more rolled than his Early Soan tools. The handaxe group occurs on the same terrace on which were also found so-called pure Soan types, but both these groups never occur together. We have no idea of the areal expanse of this terrace, but judging from the comparatively small size of this tributary stream of the Indus it is difficult to imagine the existence of two sets of people practising two different traditions in a restricted area. More so when both of these industries are dated as of the same period.

On the basis of the characteristics of the handaxe culture of Peninsular area and those of the Soan implements I happened to examine at the Cambridge and at Florence I am inclined to regard that the Soan is not an independant and distinct culture. As far as Guler and Nalagarh collections are concerned I would prefer some patience for the present, although, I feel, that in these areas also it is the environment, which chiefly determines the peculiar character of the implements.

COMMENTS

H. D. Sankalia :

The reason why this topic was kept for discussion is that during the last ten years or so, a large number of pebble tools have been found from different parts of India and, therefore, the Soan was not the only pebble tool complex in India. Moreover doubts have been expressed by a number of scholars regarding the Soan as a separate culture. I, therefore, thought that this subject should be kept for discussion at the Seminar.

With regard to the pebble tools from the rest of India and those which have been described by De Terra, I am of the opinion that there is a fundamental difference : While we can generally call them as pebble tools, still the technique employed in the Punjab, particularly in the Soan valley, was of different type, and if this is the main criterion, then it will appear that the tools from other parts of India would be found to be different, though they are also made on pebbles or pebble-halves,

G. C. Mohapatra :

Sri SOUNDARA RAJAN opened the discussion with a note of doubt that the Soan perhaps does not fulfill all the requirements of a culture. He has specifically pointed out that the Soan does not have " more than one industry or a group of techniques set in an evolving socio-material matrix. The Soan culture on this count, would seem to fall short of the definitional scope and would, at best, seem to be an industry displaying the rise, perfection and degeneration of the prepared platform technique". But a little later he says, " The Soan by its very typical typological character is certainly an entity by itself and should thus be eligible to be called a " culture ". In order to come to this conclusion he, in a few sentences, has tried to make a compromise between the so-called technical deficiencies of the Soan and its typical typological character with reference to a closely knit group of people or the Soanian society. This sociological hypothesis to solve an archaeological problem not only leaves the prehistorians in the air but also shows Sri SOUNDARA RAJAN's lack of enthusiasm in keeping track with the recent researches connected with this problem. Although he has devoted most of his time to the discussion whether the Soan entered the Peninsular lithic cultures or not we propose to fall back upon the basic topic i. e., the status of the Soanian as a culture.

Fortunately, I am in agreement with Sri SOUNDARA RAJAN in his remark that " the Soan by its very typical typological character is certainly an entity by itself ", but this is not the sole criterion on the basis of which I am going to designate the Soanian as a culture. To me, it appears that the Soanian is a culture, as good as any lithic culture of the Peninsular India, containing more than one industry or a group of techniques which contrary to Sri Soundara Rajan's remarks, have evolved through the passage of time giving rise to various later facies. On the basis of the work done by D. SEN, B. B. LAL and myself we are in a position to assert that in East Punjab the earliest manifestation of the Soanian is clearly represented in the Beas-Banganga valley. A slightly evolved industry is seen in the Sirsa valley which contains pebble tools with advanced techniques and flakes with prepared platform etc. Then we come across a small flake-industry of chert at Ror in the Banganga valley. From the terrace sequence in that region it is observed that this industry occurs in a lower terrace (T^{4}) while the upper terraces ($T^{1,2,3}$) yielded only the Early Soan type of tools. In this industry the Soanian pebble element in clearly manifested in the form of pebble cores, scrapers and a large number of nondescript pebble nodules (fractured and flaked). Typo-technologically the Sirsa valley industry may be placed in between the Early Soan industry of the Beas-Banganga valley and the small flake-industry at Ror. These three industries displaying a common pebble-technique plus the total absence of handaxes and cleavers clearly suggest the existence of an exclusive idea which took the shape of a distinctly typical lithic culture in the northwestern part of our subcontinent.

A detailed study of the Stone Age artifacts collected from the East Punjab region will reveal that the three industries have a common ancestry i. e., their source is the pebble chopper-chopping tradition which characterises the Soanian.

This tradition can be regarded as the nucleus from which later on developed a culture the early phase of which is seen in the Beas-Banganga valley, the middle phase in the Sirsa valley and probably the most developed phase at Ror. Sri SOUNDARA RAJAN probably was not aware of these facts and possibly considered the Early Soan pebble choppers as the sole representatives of this culture. Gradually we are covering more area and bringing out more material. It is not improbable that we will find more industries in the course of time which will display newer techniques or types of tools in this culture. We have already made a beginning with fairly satisfactory results. At least now it is clear that the Soanian has more than one industry and displays a group of techniques which were probably, in the words of Sri SOUNDARA RAJAN " set in an evolving socio-material matrix". Therefore, there should be no doubt about the status of the Soanian as a culture and it will be a gross underestimate to consider it, any more, as only "an industry displaying the rise, perfection and degeneration of the prepared platform technique".

P. C. Pant :

My comments on the subject are limited to my own recent investigations in central India. In January this year, I with two of my students discovered a true pebble-tool-idustry at Lahchura (Lat. 29° 19′ N; Long. 79° 18′ E) at the junaction of Hamirpur and Jhansi districts of U. P. and Chhatarpur district of M. P. The village of Lahchura is situated on both banks of the Dhasan, a tributary of the Betwa, near the recently constructed Lahchura dam.

The tools were found on the western bank of the river and on the slopes of the hill to the east of the dam.

A cemented gravel, from one to one and half feet in thickness, directly lies over the heavily eroded and weathered granite bed-rock on the west bank of the river. This gravel deposit is covered by a thick layer of coarse sandy alluvium. At some places, two more gravels, intervened by alluvium, are also visible. These later gravels are almost identical in nature with the basal gravel, and are probably redeposited from the same. One chopper and one flake were found *in situ* in the first gravel and a single chopper and two flakes in the uppermost gravel. The basal gravel of Lahchura is roughly comparable with the basal gravel of other central Indian Stone Age sites, containing Early Stone Age tools of Madras facies. In total 133 tools were picked up, most of them being fairly fresh. All of them are made on pebbles or flakes struck thereform. Seventy three percent of these are made of quartzite the remaining ones being of granite, opal, jasper and quartz. Pebble shapes are mainly sub-angular to oval, and only a few are spheroid. Only three split pebbles were found. There was preference for using naturally flat-based pebbles for implements of chopper-chopping tool family and seventy nine percent of the total collection are of this variety. The number of unifacial choppers comprises sixty-eight percent of the total collection, while the bifacial chopping tools are only fourteen percent, and cores, proto-handaxes and flake tools only ten percent, and the rest are small waste flakes. The

cutting edge of the choppers and chopping tools is on the end, side or corner and is straight, curved or slightly pointed. Out of a total of thirty flakes, only nine could probably be used as implements, rest being simply waste flakes. All the flaking is of ' block-on-block ' variety. Some of the pebbles bear only a single flake scar and even then they could be used as implements. In short, the industry is essentially very crude and a tendency may be seen throughout to exert as little effort as was sufficient to make a particular kind of tool.

The typology of tools suggests that it is undoubtedly a full-blooded Early Soan industry. (This conclusion was also confirmed by Sri A. GHOSH, and Sri V. D. KRISHNASWAMI, when the collection was shown to them.) But, at the same time, it should be pointed out that it differs from the other Early Soan industries of northwestern India, at least on two points. Firstly, the latter contains a greater percentage of flake tools in comparison to former, and secondly the flat-based split pebbles are rare in Lahchura industry, while they are in a considerable number in the latter. Both these points probably indicate the primitiveness of the former as compared to latter.

The discovery of a true pebble-tool industry, devoid of any Abbevillio-Acheulian elements at Lahchura, not very far away from Lalitpur where Prof. H. D. SANKALIA found a factory site of handaxe-cleaver culture complex, is, of course, important to justify the existence of a separate pebble tool culture in India, named Soan culture. Now we are probably in a position to say that this culture was not limited to northwestern India only but extended upto at least a part of central India. If we find some industries of Abbevillio-Acheulian facies, containing a considerable pebble element, in central and northwestern India or in the Deccan, it does not justify us to question the very existence of a separate pebble-tool culture in the sub-continent. We should not hesitate to admit that at present, our studies are insufficient to account for this peculiar mixture. To my mind, the Soan and the Madras cultures belong to two different techno-typological traditions. The former had a preference for cutting and scraping implements made on pebbles, while the latter for digging tools made on cores. When I say digging tools, I have in my mind the earliest crude handaxes, with some haphazard flaking near the point and with zigzag sides which could not be used for any purpose. Of course, in its later stages of development, handaxe might have become a multipurpose tool but basically it must have been a digging tool. The tools represent the needs of the people who manufactured them. And in this respect also the Soan culture people seem to be different from the people responsible for Madras culture, as suggested by the typology of the implements.

V. N. Misra :

I shall plead at the outset that the discoveries of DE TERRA and PATERSON in Soan basin should be put in the proper perspective. I have a feeling that the importance of their work has been unduly exaggerated by us. For instance, the so-called Pre-Soan culture is known to us by only a single line-drawing, and five half-tone, illustrations of flakes, some of which are quite unclear, in DE TERRA and PATERSON's work (1939). Yet for all these years we have taken the cultural

status of the Pre-soan culture for granted on this slender evidence and ultimately it was left to a British archaeologist (Oakley, 1957) to question the very genuineness of Pre-Soan flakes. Although the evidence for Soan culture is relatively more, yet this too is not adequately presented. We do not know the relative strength of the various tool types in Early Soan and Late Soan cultures. This, however, is an important thing. For until we know the actual proportion of different tool types, we cannot have a clear idea of the nature of the culture. In fact the lack of such data has already given rise to various interpretations of the Soan culture.

Further, in the deposits of the Second Interglacial Age in which the Early Soan tools are found, the tools of Abbevillio-Acheulian culture also occur. How far the absence of handaxes at the so-called Early Soan sites is due to limited collections or accident, we do not know. Without some fresh field work in the original area, it is difficult to arrive at any conclusion in the matter.

Sri Soundara Rajan states in his paper that Soan Culture is a " monotechnical tool-outfit " and at best can be called " an industry displaying the rise, perfection and degeneration of the prepared platform technique ". This view indeed is in marked contrast to the observations of De Terra and Paterson as well as of subsequent writers on the subject. In fact, at least three techniques are clearly represented in the Soan culture, namely, the pebble tool technique, the Clactonian technique, and the Levallois technique. The evidence for this has been so clearly put forward by De Terra and Paterson, Movius (1944) and Sankalia (1957) that there is hardly any room for confusion or different interpretations. In fact the prepared platform technique which Sri Soundara Rajan regards as the hallmark of the Soan culture appears only in Late Soan A and becomes effective only in Late Soan B. In Paterson's own words (1945) the Soan " is essentially a tradition of pebble tools ".

My final point is about a discovery made by Dr. A P. Khatri (1963) in the Narmada. It has an important bearing on the problem we are discussing today and yet it seems to have gone unnoticed. Dr. Khatri claims to have found an Oldowan culture below an Abbevillio-Acheulian horizon at Mahadeo Piparia in Narasinghpur district, Madhya Pradesh. According to him at this site an evolution from pebble tools of Oldowan stage to handaxes of the Acheulian culture, identical to that found in Africa, has taken place. This discovery to my mind is very important as it affects some of our basic ideas of prehistory. For until Dr. Khatri's discovery there was only one site in the world, namely, Olduvai Gorge in East Africa, where an evolution from pebble tools to handaxes of Acheulian stage was known. It had therefore been thought that handaxe culture evolved in Africa and thence spread to other parts of the world. Dr. Khatri's discovery calls for a change in this position. Instead it would now appear that the handaxe culture evolved independently in India from a basic Oldowan stage and (by implication) spread to other parts of India and possibly outside as well.

My reason for inviting your attention to this discovery is twofold : first my colleagues and I have recently explored the very area and indeed examined

the very deposits which Dr. KHATRI has explored but we have failed to notice any Oldowan horizon or find evidence for the evolution of the handaxe culture. As far as I am aware, the experience of other workers in the area, notably Dr. R. V. JOSHI and Sri D. SEN, has been similar. Secondly, the recent geochronological studies by the late Prof. ZEUNER in the Mahi and by Dr. WAINWRIGHT in the Narmada suggest that the handaxe culture in India may be as late as the Last Interglacial age. This would appear to be a very late period for the evolution of the Oldowan culture into the handaxe culture, for in Africa this event now appears to have taken place in pre-Pleistocene times. Thus it is clear that Dr. KHATRI's observations run counter to those of other workers in the field. However, in view of the tremendous significance of Dr. KHATRI's discovery, the situation should not be allowed to remain uncertain. I would therefore request Sri A. GHOSH, and Prof. H. D. SANKALIA to organize an expedition to investigate the matter fully in the field and report its findings at an early date so that the question can be settled beyond doubt.

S. P. Gupta :

By now a dozen or so sites of the Soan culture have been explored on the Beas, Banganga, Sutlej, etc. A recent survey of the Sutlej near the town of Bilaspur by the students and teachers of the School of Archaeology brought to light a sequence of three implementiferous terraces. Out of a large collection of tools made from these terraces no handaxe or cleaver was found. The two Guler handaxes published by B. B. LAL are not real handaxes in my opinion. Nalagarh has also not produced any such tool nor the recent excavation by MOHAPATRA at Ror in the Kangra District, even though the excavation was done on T^3. This implies the acceptance of the Soan as a separate culture of the chopper-chopping-tool complex which probably originated in the Sutlej basin and remained confined to that area for a very long time. This suggestion regarding the origin of the Soan culture is based on two facts : firstly, the nature of the chopper-chopping-complex in the Sutlej is better defined as a separate culture because it is unmixed with handaxes and, secondly, because at many sites in the Soan region tools of handaxe tradition are found mixed with the chopper-chopping tools. Of course, this suggestion can only be confirmed finally when priority or contemporaneity of the Sutlej terraces over or with, the Soan terraces is fixed.

Another question is whether the chopper-chopping pebble tools found along with the handaxe complex in the Peninsular India are identical with those found in the Soan region. Dr. SANKALIA mentions the technique of 'underslide up' flaking as the specialized technique of the Soan. The same technique can be noted in many specimens from peninsular India. I feel that it is really difficult to pin point the differences, if at all they exist. But at the same time we should not presume that this identity implies an extension of the Soan tradition into the south. No great specialization of tool-making technique should be imagined at such an early stage.

Sri PANT thinks that the handaxes were digging tools and the choppers cutting. In fact both of them were all-purpose tools. Dr. LEAKEY has prepared a film showing the various uses to which a handaxe or a chopper could be put. However, for cutting ligaments flakes could be more effective.

I agree with Dr. K. D. BANERJEE and Dr. KHATRI in so far as they have indicated the differences between the Soan complex and chopper-chopping complex of Burma, Java and China. The broad generalisation by Movius may have to be slightly revised as our studies develop.

Finally, I would like to comment upon the discovery of the pebble tool culture called Mahadevian, in the red greasy clay deposit of the Narmada at Mahadeo Piparia by Dr. KHATRI (1963). The culture consists of crudely flaked water-worn pebbles with rough and jagged cutting edges. Among these are also specimens which suggest the form and shape of the crudest type of "Chellian handaxe". Thus the exact comparison of the Mahadevian lies with the Chelles-Acheul assemblage found at the base of the Bed II of Olduvai Gorge and not with the Oldowan of Bed I. To call it an Oldowan culture is thus inappropriate and misleading.

The suggestion of the date of the early Middle Pleistocene for the Mahadevian is slightly speculative. There is no fossil evidence for it and the stratigraphic position of the red greasy clay has been questioned by SANKALIA and SEN. While KHATRI takes this deposit pre-Basal gravel, Sen (1964) has taken it to be post-Basal gravel. And even if we accept the claim of KHATRI, Mahadevian cannot claim the antiquity of Oldowan. This dating can only suit the Chellian stage.

Finally, as LEAKEY (1951) and CLARK (1962) have pointed out the term 'pebble culture' is not a substitute for 'Oldowan culture'. In the Oldowan culture, according to LEAKEY (1951, 36), "specimens occur which have been made from nodules of chert and others from rough irregular lumps of quartz and quartzite, and there seems to be little doubt that sites containing assemblages of this culture may be found where tools made of actual water borne pebbles were entirely absent". On the other hand, as CLARK (1962, 270) says, "industries made from pebbles are known from many different periods." Observations of these scholars make it absolutely clear that only the preponderance of pebble-tools in any given assemblage is an extremely risky criterion for calling it 'Oldowan'.

Reply by K. V. Soundara Rajan :

The trend of the discussion by the various participants has been fairly divided on the view as to whether Soan should be treated as a separate culture or not. Most of the members have referred to the relationship of the Soan with handaxes in the early and later stages in the same terrace, on the basis of DE TERRA's and other more recent data. But it is my view, and this is fairly supported by Prof. D. SEN's note also, that while the Soan, by its evolution, nature and variation of tools and technique involved, seems to be independent

from the handaxe culture evolution and is essentially a regional industry or culture, it did have contact with the handaxe culture quite early in its growth. The socalled Pre-Soan has no direct nexus with the Soan and is certainly not well known yet. It is, however, as it should be, that it was a primitive large-flake industry, if at all it could be called an industry. On the Indian side, however, we do not have yet any site where we have either a pre-Soan cultural stratum or the handaxes occurring along with the Soan. The Indian sites in Beas, Banganga and Sutlej valleys may be either a stagnant continuum of the Soan culture or they might have been the earliest parent zone for Soan evolution. But the former seems to be more valid, since we have in T^4 of Guler, flake tools (collected by the Prehistory Branch of the Archaeological Survey of India) akin to Late Soan of elsewhere, and the general run of the evolution of the tools in relation to the terraces would seem to be similar in the different valleys in Indian Punjab.

We should, however, do well to watch not only what work has been going on in Pakistan, as by GRAZIOSI, as well as in India itself in areas of Punjab which are not yet tackled. But the extant evidence uptodate seems to be in favour of considering the Soan as a viable local development which did not benefit by, nor showed the consequences of its impact, whatever may be their nature, with the handaxe culture early in its evolution.

As regards Dr. KHATRI's Mahadevian industry of Narmada being akin to Oldowan, Dr. MISRA's and Sri GUPTA's remarks show how anamolous such a stand could be from the stratigraphical and technological view point. It is obvious that, if at all we should have yet a pebble stratum of a pure and pre-handaxe type, it has eluded us till now, and we may carry on more to see if there is such a scope.

NOTES

1. According to Prof. Paolo Graziosi (of Florence University), who recently worked in W. Pakistan, the pebble and biface cultures may be found together with flake culture with prevalence of one or another of these cultures according to the period. He is of the further view that there may exist a primitive industrial stage containing proto-types of the handaxe (vide a letter to the writer). His book on the Prehistory and Anthropology of Pakistan is now being published in Italy.

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SOME PROBLEMS CONCERNING PLEISTOCENE STRATIGRAPHY OF INDIA WITH REMARKS ON POLLEN STRATIGRAPHY

VISHNU MITTRE :

Of all the aspects of the Pleistocene Period in India, Pleistocene stratirgaphy has not received the attention it deserves. Despite the creditable work of some investigators, the reconstruction of Indian Pleistocene stratigraphy still remains incomplete and sketchy. The bearing of studies of Pleistocene stratigraphy on several other aspects of the Pleistocene period can hardly be overemphasised. It is, therefore, all the more important now when we have begun to feel the necessity to tie up considerable data discovered within the last few decades concerning some other aspects of this period that we should plan and organise our researches so as to build up the background information of stratigraphy through the application of modern techniques.

We have luckily in our country vast tracts of the glaciated, the periglacial and the unglaciated areas, thick and extensive fluvial and eolian deposits and the coastal regions, in short materials of all kinds which if properly and systematically investigated can enable us to contribute to the concepts applicable to the Pleistocene period all the world over.

It is needless to point out the need for the study of the fundamentals of the stratigraphy especially in relation to the varieties of climate, drainage pattern, physiography and vegetation obtaining in India and to guard against the approach which is largely based upon fitting the facts discovered elsewhere into the stratigraphy of India. In principle it may be all right but in the manifestations there may be differences of far-reaching importance.

There are certain aspects of Pleistocene stratigraphy which have hardly received any attention in India such as the shore line and the snow line changes, the recognition of periglacial features, effects of stream transport on the nature and deposition of sediments, the study of the graded deposits, pediments and the factors governing their formation, deep sea core stratigraphy, terrace formation, the principles of stream behaviour, rates of sedimentation and the principles and thought in formulating the stratigraphical classification of the Pleistocene etc.

We have, however, built up some information regarding the glacial sequence in the northwest from river terraces and glacial deposits and a more or less similar pluvial sequence from central and southern India. There have been attempts also towards the correlation between the glacial and the pluvial sequences of the North and the South. Though these preliminary efforts have proved quite rewarding, they are merely in the nature of glimpses of Pleistocene stratigraphy. Extensive field work in every region is required to build up the local stratigraphical sequences which may first be correlated with the sequences from the neighbouring regions and thereafter an all India correlation can be attempted.

In such wider correlations between the N and S, no attention had been paid to the local factors some of which might have had overriding influence over the others. Attempts have been made to adopt the nomenclature of alien sequences to those of ours without considering the hazards of such attempts despite the universality of the Pleistocene events. For our own sequences we ought to evolve our own nomenclature from numerical to binomial after the locality or region and then large-scale correlation may be built up.

The problem of the correlation of pluvials in South India with the glacial stages of the North should not only be solved through the study of river terraces and strand lines and the nature of the deposits and the raised beaches besides the fossil life forms but also through the establishment of the fact whether the pluvials and glacials are correlatable on both the fluctuations in temperature and moisture. Whereas the worldwide and contemporaneous nature of fluctuations in temperature has established the soundness of the Glacial theory, the Pluvial theory has yet to demonstrate that and until that is achieved the correlation between the pluvials and the glacials may be looked upon as tentative. The repeated wet and dyr sequence during the Pleistocene may as well compare with the wet and dry fluctuations of an interglacial climate and not necessarily with any glacial phase. Recent research is gradually establishing that the climate during the pluvial period comprised reduced evaporation together with lowered temperatures rather than increased precipitation. This necessitates a careful study of the present and the past convective (monsoons) and cyclonic precipitation (winter rainfall) in India. The Pleistocene stratigraphy ought to be examined against this background.

Without going into the nature of formation, the river terraces in India have been in most cases correlated with glacial or pluvial phenomena. The periodic basin, or the lowering of temporary base level through removal of obstruction, or a combination of both might be responsible. Further, the origin of terraces might be attributed to intermittent degradation of stream ways and lastly to the alternate arid/humid conditions.

It may seem too early to draw attention to establ'sh and recognise the rock-stratigraphic and time-stratigraphic units as applicable to the Pleistocene stratigraphy of India. The utility of the recognition of time transgressive and time parallel lithological units need not be stressed.

The origin and significance of black and red soils in India constitutes another problem in Indian stratigraphy and attention to this has been drawn frequently by geologists in the country.

Whereas stratigraphical studies in the regimens of rivers have brought out a repeated succession of gravel and silt, deep borings in the Indo-Gangetic plain especially at Ambala, Agra and Lucknow have brought out several hundred metres thick deposits comprising alternate clayey and sandy deposits. Borings in the Bengal basin and Pondicherry have shown the presence of alternate clayey and organic beds. Besides their correlation with the gravel silt sequences in other

parts of the country constituting a big problem confronting us, these thick columns of sediments provide us with materials to determine the phases of subsidence and emergence of land and the sea and land level changes. Their correlation with the glacial or pluvial phases on the one hand and with the tectonic movements on the other is another important problem in Pleistocene stratigraphy of India. The submerged forests and peat deposits at the Western end of Valimukam Bay in the Tinnevelly district, and the burried forests at the Princes and Alexandra docks in Bombay and the presence of estuarine shells in the coastal areas at a considerable height above the sea are some examples which deserve our attention the most.

After drawing attention to some of the important problems in Indian Pleistocene stratigraphy awaiting our attention, an outline of the prosepcts of pollen-analytical approach towards the solution of some of these stratigraphical problems is described below. In brief, the pollen-analytical methods help in the establishment of what may more appropriately be called ' Pollen Stratigraphy '.

Pollen grains, as you may be knowing, are the male reproductive cells produced in enormous quantity by plants. They are dispersed by wind, water, or insects so that some of them reach the female parts of the flower on the same or other plants—the vital function for which they are produced. Most of the wind pollinated pollen remains afloat in the air, thus constituting pollen rain, and gradually settles down on the ground either due to gravity or washed down by rain. Pollen that happens to fall on the moist surface of a swamp, marrh or in the lake is eventually incorporated in the sediments with its indestructible outer coat preserved for ever unless eaten or burnt. The structure of the outer coat possesses certain characters which help in assigning it to its source of origin. The morphological, statistical and ecological evaluation of these sub-fossil pollen memberances, after their release from the sediments by chemical treatment, constitutes what is popularly known an ' Pollen Analysis '. It is chiefly based upon the established fact that the statistical evaluation of pollens in the pollen rain and in the sediments faithfully reflects the vegetation from which they have been derived. Vegetation being most sensitive to even the minor climatic and edaphic changes and biotic influences, its reconstruction from sample to sample in a profile provides us with the necessary changes in climate and soil, which are designated as ' Pollen Zones '. The sequence of pollen zones in relation to stratigraphy is called ' Pollen Stratigraphy '.

Since the Pleistocene period, the shortest in the geological history, has witnessed a succession of climatic alternations not known hitherto in any other geological horizon, the deposits laid during this period have to be examined against the background of the climatic changes. Pollen analysis provides an important tool for this purpose. It is needless to point out here the contribution of pollen to the solution of problems in Pleistocene stratigraphy. A few words will, however, be added about the prospects for pollen analysis in connection with the Pleistocene stratigraphy of India.

The Department of Quaternary Palaeobotany at the Sahni Institute of Palaeobotany, Lucknow, has been engaged in the pollen-analytical investigations of the Pleistocene deposits of India. From time to tume Sri B. K. THAPAR of the Archaeological Survey of India and Prof. H. D. SANKALIA of Deccan College have been kind in sending us materials for pollen analysis. Prof. SANKALIA has also been kind in providing me with the opportunity of visiting the sites under excavation and collecting the materials therefrom. Samples have hitherto been pollen-analysed from Maski, Nevasa Ahar, Kuchai and Baidipur. However, except from Maski, the samples from these sites have proved barren which may be due to either the unfavourable nature of the climate or the unsuitable nature of the sediments for the preservation of pollen.

From other sites such as the Lower Karewas and Postglacial deposits in Kashmir, Postglacial deposits in Kumaon Hills, mangroves of Bombay islands, Nilgiris, and Bengal basin, the samples have been found to be fairly rich in pollen. Amongst these the pollen stratigraphical work in Kashmir and Kumaon has reached an advanced stage while the work on the other sites is progressing.

The work on the Lower Kerawas and its impact on the Upper Siwaliks has brought out results of far reaching importance. It has enabled us to draw the Plio-Pleistocene boundary at the base of the Pinjor beds and to assign the Pinjor beds to the Preglacial with the commencement of the first Glacial on top of it. In the Lower Karewas, of the five lithozones recognised by DE TERRA and PATERSON (1939) the pollen evidence assigns Lithozone 1 to the Preglacial, the top of Lithozone 1 and the base of Lithozone 2 to I Glacial and the remaining lithozones (the fifth still uninvestigated) to the I Interglacial. The conclusions are set out in Table 1.

The recognition of pollen zones in the Postglacial profiles is still awaiting. They have, however, brought out a complete sequence of climatic alteration and the progressive development of agriculture in the Kashmir Valley since the Neolithic forest clearances.

In India the pollen-analytical approach is still in the stage of infancy. It is very much hoped that with the cooperation of experts gathered here it will certainly provide us with a complete sequence of pollen stratigraphy in India besides providing background information on the environment to various cultures and their development in India.

The above outline of some important problems in Pleistocene stratigraphy of India reveals that there is no dearth of material in the country. What is, in fact, required is the organization of team work and that can be achieved if a committee of specialists is constituted to undertake this project.

Table I

Showing the Stratigraphical, Palaeontological and Palynological Correlations of Upper Siwaliks, Bain Boulder Bed and the Lower Karewas.

		UPPER SIWALIKS	SECTION AT BAIN	LOWER KAREWAS (With the stratigraphical zones)	
				MORAINES	LITHOZONES
PLEISTOCENE	II GLACIATION	CONGLOMERATE UPPER	*E. planifrons, E. hysudricus, Equus, Bos*		5
	I INTERGLACIAL	CONGLOMERATE MIDDLE		Deciduous woods Oak conifer woods Upper Transitional Stage	4
				Pine woods	3
	I GLACIATION	CONGLOMERATE LOWER	BAIN BOULDER BED	LOWER Transitional Stage	2
	PREGLACIAL	PINJOR Stage	*E. planifrons, Equus, Bos or Bubalus.*	Oak woods	1
TERTIARY	PLIOCENE	TATROT Stage			

R. V. Joshi :

We are now well conversant with the Stone Age tool-bearing horizons in India. Basically we have only two (or three) gravel sequences, the older of which yields the Early Stone Age material and the younger contains the Middle Stone Age industries. We may call these as two or three cycles of sedimentation, but I feel it may not be possible to say as yet what climatic cycles they represent. In the present paper I propose to review the work on the Stone Age stratigraphy in India and to make some observations on the methodology that is being followed in this research.

Of the several methods employed in interpreting Pleistocene stratigraphy in India at one locality or in correlating the stratigraphic data of several localities situated far apart, presently only two methods seem to be of some importance. These are the palaeontological method and the method based on the study of river deposits.

De Terra and Paterson (1939) have worked out the Pleistocene glacial deposits. Although this method is quite sound and of universal application, its utility is restricted to a certain geographical region. Some of us have examined the sections studied by De Terra and Paterson in the Kashmir basin and we are now aware of the complicated nature of the deposits exposed in the river valleys in Kashmir. De Terra attempted a correlation of the glacial deposits in the Kashmir basin with the terrace sequence in the Potwar region. But unless some of us get an opportunity to examine the whole data in the field it is difficult to comprehend De Terra's interpretations.

When some prehistoric sites were discovered in the Banganga basin and in the Sutlej valley (Nalagarh etc.) we had an occasion to employ De Terra's methodology. The results from these areas are, however, not encouraging. Besides, the only evidence of some moraine-containing erratic granite-boulders encountered in the deposits of T^2 terrace in the Banganga valley, we have absolutely no data to connect the Banganga terrace sequence with any glacial sequence. To what phenomena—tectonic or glacial or combined—the Banganga terraces belong cannot yet be said with certainty.

The majority of the Stone Age sites in India are far removed from the glacial or periglacial zones and as such we will have to build up the Pleistocene stratigraphy of our country only on the two methods referred to above. Yet another method seems to be promising on the east coast of India. A careful survey of the tract between Madras and Mayurbhanj may perhaps yield important evidence on the possible Pleistocene sea-level changes, which in turn may be useful in connecting the stratigraphy of the Stone Age sites on this coast. Interesting results have been already achieved in a similar work by Drs. Zeuner and Wainwright in the lower Narmada Valley.

The only solid foundation on which we can build our Stone Age stratigraphy is the palaeontological method and fortunately we have the sites in the Narmada and the Godavari basins[1] which yield fossils as well as stone artefacts. In fact we should make the Narmada and the Godavari valleys standard for the Pleistocene stratigraphy of our country.

Following DE TERRA's stratigraphical data on the Narmada quite a number of field workers have re-examined, in parts, the sections referred to by DE TERRA. Although there is consensus of opinion that DE TERRA's sections are defective, no conclusive results have been put forward. From the reports of various experts who examined the Narmada valley between Hoshangabad and Narsinghpur, we know (i) that the basal laterite is absent in the valley; (SANKAHIA, 1962, 51-54); (ii) that the basal gravel sequence begins with the clay on the rock (KHATRI, 1963); (iii) that there is no uniformity in the sections and all the deposits represent a complex formation (MALIK and WAINWRIGHT in private correspondence); (iv) that the beds which were reported fossiliferous by De Terra are unfossiliferous (SANKALIA, 1962, 52, based on T. D. MCCOWN's observations).

Some scholars have worked out the stratigraphy of the Maheshwar in term of the river terraces (SANKALIA, 1962, 80-81), while some have found evidence in the adjoining Adamgarh hill at Hoshangabad which corroborates certain deposits exposed on the Narmada near Hoshangabad (JOSHI and KHARE, 1962, 414). Some have made massive fossil collections from the Narmada, but unfortunately the stratigraphy and the climatic sequence derived from it are somewhat confusing (KHATRI, 1962).

As I have pointed out above, the Narmada should be the standard region which will have to be re-examined thoroughly. The stratigraphy will have to be worked out independently first in each sector of this valley with a careful study of the morphology of the river. This aspect has been sadly neglected in all the previous observations on this river. For example, we have no knowledge of the structure of the valley at each stage; whether any part of this valley represents ancient rift-valley lakes; what was the nature of the pre-Pleistocene river-bed; what was the influence of the knick-points, water-falls, and the structure of the different geological formations traversed by the river. Whatever has been said of the Narmada applies to the Godavari as well. And I feel that by the detailed studies of these two major rivers which follow respectively the western and the eastern courses and drain in the Arabian sea on the west coast and the Bay of Bengal on the east, we will have achieved a very solid foundation on which to build up in future the stratigraphy for the whole country.

In the rest of the areas the stratigraphy will have to be worked out on the basis of the geological deposits like gravels, sands and clays in association of which occur stone implements. Being situated away from sure palaeontological data, utmost care will have to be taken in examining the sections in such areas. In the following pages I propose to make some observations on these points.

In Indian Pleistocene stratigraphy laterite has assumed a certain importance. Its occurrence at any Palaeolithic site is being utilized for interpreting either the climatic cycles of the region or the relative antiquity of the artefacts found in its association. By its mode of formation this geological deposit is distinguished into two types : Primary laterite and Secondary laterite. Inspite of its economic importance as a source of iron, manganese and bauxite, sufficient attention has not been paid by geologists to investigate its correct mode of

formation. Particularly from archaeological point of view we will like to know the part played by climate in this kind of weathering.

We have been told by some authorities that this formation generally represents a wet phase (ZEUNER, 1960). I do not agree fully on this point. The tool-free laterite has been reported at the base of stratigraphy. Since it underlies the tool-bearing deposits here it represents merely a geological formation like any other country rock. The lateritic weathering is a characteristic feature in monsoonal lands and when the laterite occurs at the base of a certain stratified deposit the only inference that can be drawn is that it was formed from certain rocks under the monsoonal climatic conditions. No doubt it is a very good evidence to trace the beginning of monsoonal climate in India. It is true that at some early geological periods also laterite seems to have been formed. But when the seasonal character of the monsoon-climate is due to the disposition of land and water in this part of the world, there may have occurred suitable morphological features in the early geological periods to initiate the monsoon-type climate (JOSHI, 1961).

The monsoonal climate, as we know, is characterized by heavy seasonal rainfall (about 125 cm.) followed by a marked dry season. In certain areas of India the alignment of hills causes uneven distribution of rainfall. Most of these areas are the coastal lands where occurs the maximum formation of laterite. Thus it is not necessary to have a marked pluvial or exceptionally heavy rainfall for the laterite formation. In fact high rainfall may inhibit the lateritization process. So far as archaeologists are concerned this primary laterite occurring at the base of the Stone Age stratigraphy denotes the beginning of monsoon-type climate and since this kind of climate may have been initiated in India in Pleistocene or at the beginning of Tertiary, the only inference that can be drawn from its presence here is that the base of this stratigraphy belongs to the Pleistocene (or Tertiary to Pleistocene) period.

Whenever stone tools occur in association with laterite, the latter is of detrital type. The secondary and derived character of this laterite makes it unsuitable for climatic interpretations. It would have been of some importance had it occurred as a deposit intervening the tool-bearing and other deposits.

Lateritic patination has been often used in typological studies to distinguish the earlier and later tools. But it has now been noticed that this leads to erroneous conclusions, viz. the tools of Acheulian and post-Acheulian characters have been found intensively affected by the laterite deposit than the so-called earlier crudely made artefacts. Such examples are numerous at Attirampakkam site. Dr. ZEUNER (1961) had initiated the study on this line from his collections from the Madras area and I had already pointed out the defects in this method at the first Asian Archaeological Conference.

Insufficient description of the tool-bearing gravels also leads to wrong deductions. When there are two gravel-beds they are often reported as coarse and less coarse, but unless we have the idea of the size of pebble components we cannot compare the gravel-beds of widely separated areas. Cement-

ing medium is also often not correctly assessed nor the degree of compactness properly given.

Up till now we have no purely geological method to correlate the gravel-beds from different rivers. We are following the same archaeological method for this purpose and we are all aware that this creates difficulties for detailed scrutiny of the industries. Unconformable junctions have certain significance and they should be shown according to geological conventions. In the finer gravels or sandy deposits we often come across cross-or current-bedding. It will be interesting to see in which of the regions and horizons in the stratified deposits this appears to be a common feature before we draw conclusions whether the cross-bedding in certain deposits is due to climatic change or whether it is a localized phenomenon as a result of some morphological peculiarities.

The calcareous sandy gravels may be examined for pollen contents which would be useful for comparing the gravels from different localities.

The next question to be inquired is whether the gravel represents a wet-phase or a dry phase of the climate. In the first part of the rainy-season there is a sudden release of water which exerts a powerful pushing action on the loose rock material in the river-beds. When the rivers are flooded the top water in the centre of the stream has the highest speed while at the bottom and sides the friction on the river banks and the bed causes decrease in the velocity with the result that the coarser fragments do not move appreciably. The flood-waters, however, carry huge quantity of silt or mud in suspension and when this water spreads on the banks precipitation of the silt takes place. Thus this one complete process brings about deposition of coarse and fine materials.

The silt or clay is a common sediment exposed in the sections. In fact there will be very few sections which do not contain the deposit of this grade. But since very rarely (De Terra and Paterson, 1939, 235-48; Joshi, 1955, 35-43) or never the mechanical analysis of this material is carried out, its presence is reported sometimes as clay and sometimes as silt. In some localities this silt or clay may be a loessic deposit and unless we have analysis of such kind of material the conclusions, as regards the climatic phase, represented by this deposit, will be defective.

As in the case of other countries, in Indian Stone Age stratigraphy also the river terraces have a special importance as their existance is a clear proof of the changes in the landform brought about either by tectonic or climatic process. Since it is a geological process no wonder there will be several localities in India where some kind of terrace sequence may be seen in the stream valleys.

Some of the terraces may be of importance in our prehistoric studies. Dr. Sankalia has noticed the tool-bearing terraces in the Narmada and the Godavari. But as far as I am aware no attempt has been made to examine and plot the terrace-sequence in a sizable portion of any valley. We have no idea whether these terraces show any continuity and what is their expanse. These terraces again will have to be shown on the long profile of the river. While working in the Deccan Trap region, where the terrace aspect is imparted to the land form by the geological structure, it will be beneficial to map the trap-flows that

are exposed in the river valley before attempting terrace studies. The terrace sequence has been attempted in the Madras region but our field-work in that area shows that there is nothing like the sequence published so far. A detailed mapping of this area is therefore a desideratum.

H. D. Sankalia :

I shall like to explain why this subject has been kept for discussion in the Seminar. Some palaeontologists, when they were consulted about the Pleistocene stratigraphy after the discovery of Series II or Middle Stone Age tools in association with *Bos namadicus* and other Middle Pleistocene fossils, were wondering why there should be any doubt about the actual position of these fossils. Now as we know, the tools had come from a different stratum and they are also typologically different from the Early Stone Age tools. This definitely suggests that we have got to provide for some two or three sub-phases in the Pleistocene, both typologically and stratigraphically. On this, however, I thought that we should have first the views of palaeontologists and therefore Dr. M. R. SAHNI was invited to be the Convener of this section, and as he was not in a position to accept it, Dr. VISHNU MITTRE was invited to preside over the section. Unfortunately Dr. VISHNU MITTRE also could not come to Poona. In the absence of these experts, the members have to express their views and discuss the matter as best as they can.

G. C. Mohapatra :

Most of us now feel that the work done by DE TERRA and PATERSON, a good thirty years back, has got to be checked and reappraised in order to minimise the number of confusing problems in Indian prehistory. If we are unable to visit the Soan valley or the Potwar region and bring out conclusive proofs in support of the observations made by the Yale-Cambridge expedition we better leave them out for the time being and refrain from quoting them in support of some of our very weak hypotheses. We all now know the results of SANKALIA and ZEUNER's checking of the Kandivli section (first reported by TODD, 1939). It is needless to emphasise that during those early days it was natural for an over-enthusiastic field worker to discover in India things which should be on par with those in Europe or particularly in England. TODD had to keep with the time.

Even earlier than DE TERRA and PATERSON, CAMMIADE and BURKITT had put forward a hypothetical succession of climatic phases during the Pleistocene along the south-east coast of India which till to date has been accepted uncritically by advanced researchers and students alike. A general stock-taking of our activities for the past few decades will show that we have been engaged in picking up tools from different areas and fitting them into those patterns set by the old workers. The pitfalls are now becoming clear. Dr. R. V. JOSHI has pointed out the difficulty in applying DE TERRA and PATERSON's methodology in interpreting the Banganga terraces and we all have just now seen the confusion created by the discussion relating to the Narmada Pleistocene sequence. It is probably time for us now to see

and interpret the Pleistocene stratigraphy of a particular area in its local perspective without bias or prejudice. There should be no hurry for correlation when we know that the basic data are likely to be deficient or defective.

Another point is, how far the palaeontological data can help us in the matter of stratigraphy connected with Stone Age relics. When the palaeontologists talk of ages we are concerned with periods, that too in absolute years. One has seen an instance of palaeontological help in the case of Kalegaon and Nevasa fossils. The date is Middle to Upper Pleistocene, a period within which the archaeologist finds at least two different industries. The palaeontological research in India, at this stage, is much less developed than the prehistoric research. Excepting that a *bos* or *equus* bone is identified and roughly dated to some part of the Pleistocene no precise help can be expected from the vertebrate palaeontologists in sorting out a jumble of lithic industries according to the palaeontological dates. To understand the complexities involved in stratigraphy nothing but a sound knowledge of geomorphology is needed which is sadly lacking in many of us.

Dr. JOSHI has very wisely pointed out the influence of the geological structures over the so-called terraces in the peninsular India. Utmost caution should be exercised before we come to any conclusion regarding the terraces specially in the lateritic regions, the Deccan Trap area and the west coast specially near Bombay.

S. N. Rajguru :

I agree in general with the views expressed by Drs. VISHNU MITTRE and R. V. JOSHI, at the same time I have to put forward some views of my own regarding certain points discussed in their papers.

Study of deep sea cores (which generally include O^{18}/O^{16} isotopic method and determination of calcium carbonate content of unit volume of sediment) will definitely give us more information on palaeotemperatures in the Indian ocean and will help to confirm and improve terrestrial time scale for the Pleistocene. But as the application of this method requires highly advanced equipment, and specialized training, I do not think that it will be employed in the immediate future in our country.

Dr. MITTRE says that "repeated wet and dry sequence during the Pleistocene may as well compare with the wet and dry fluctuations of an interglacial climate and not necessarily with any glacial phase". It is very difficult to understand how wet and dry sequence could compare with wet and dry fluctuations of an interglacial climate only, when there were stadial and interstadial phases during glacial period also.

In Peninsular rivers we rarely come across good terrace sequences. However two cycles of sedimentation are uniformly seen in these rivers. These cycles, in most cases, have been attributed to the Pleistocene climatic changes without proving the tectonic stability of the region on sound geological evidence. About two years back Dr. WAINWRIGHT, Sri K. T. M. HEGDE and Dr. S. C. MALIK of

M. S. University, Baroda, discovered three fossil soils near Broach on lower Narmada and on that basis dated Abbevillio-Acheulian gravels of Narmada, Sabarmati and other rivers of Gujarat to the Last Interglacial. On the basis of palaeontological evidence the same horizon in the middle Narmada has been dated to Middle Pleistocene. So on the same river we are not able to date Early Stone Age industry correctly. I do not know how far Baroda workers have considered the effect of earth movements in the Gulf of Cambay area. It has been found from the statistical analysis of sea-level data for last 80 years or so for Bombay, Karachi, Aden and Bhavnagar that Bombay, Karachi and Aden show uniform rise of about 15 to 22 cm. per century while Bhavnagar shows abnormal rise of more than 3 metres per century. This abnormal rise of sea-level at Bhavnagar and recorded earthquake tremors in the years 1938, 1940, 1950 and 1956 in Saurashtra indicate tectonic unstability of the region. Hence, I think, while studying coastal terraces or sedimentation sequences, we should give due consideration to the tectonic factor. Otherwise our results are likely to be misleading.

Modern research has shown that it is probably unsafe to interpret laterites in terms of climatic changes. Laterites are forming in many regions, some of them are characterised by monsoonal climates, some by wholly humid climate. While they are maturely developed in tropical regions (Brazil, Uganda, India) it cannot be argued that they cannot occur in temperate regions. Thus bauxite has been noted to occur on the Vogelberg in Germany and immature lateritic profiles have been found in cold regions of North China. Laterites therefore do not appear to be confined to the monsoon climate and therefore I think that Dr. Joshi's statement that "laterites are formed from certain rocks under the monsoonal climatic conditions and they provide a very good evidence to trace the beginning of monsoonal climate in India" needs reconsideration.

Regarding tool bearing gravels, sedimentological studies of both fossil and modern gravels in addition to detailed geological and geomorphological studies of the river basins may give us some information on climatic conditions of the past. Further, it is well known that while gravels and sands form the bed load silts form the suspension load of a stream. The movement of a bed material is controlled by the tractional force present at the bottom of a stream while eddies and turbulent forces affect the movement of suspension material. In addition to the mean velocity of a stream the movement of bed load is also strongly affected by the slope of the bed, channel efficiency etc. In spite of much work done on this problem by hydrogeologists our knowledge, especially regarding bed load movement and the relationship between the bed load and suspension load, is still imperfect. Therefore the picture drawn by Dr. Jsohi of the process of deposition of gravel and silt in monsoonal climatic conditions appears rather sketchy.

Dr. Joshi has also suggested that the calcareous sandy gravels may be examined for pollen contents. I am rather doubtful about the preservation of pollens in gravels under tropical conditions. Generally pollens are not preserved when they come in contact with atmospheric oxygen. Gravels may have more open texture and so the chances of the preservation of pollen in them are rather slim in tropical climates.

The problems of Pleistocene stratigraphy in India are therefore many and complex. Many qualified specialists should carry out thorough investigation of modern and Pleistocene sedimentological processes in different parts of our country. Such investigations should include, besides others, the study of pedogenesis and sedimentology.

K. T. M. Hegde :

According to the pluvial hypothesis, the heavy precipitation, which resulted in the formation of vast ice sheets during glacial periods in the north, manifested itself in the form of heavy rainfall in the south. During the interglacial periods there was less rainfall in the south. Works of DEPERET (1918) and others have indicated the genaral applicability of this hypothesis upto the Mediterranian region in the south. But the climatic conditions during these glacial and interglacial periods in the tropical regions like India are not yet known.

According to ZEUNER (1963) the pluvial hypothesis cannot be applied in Peninsular India. It has been found usually difficult to apply it in equatorial Africa. This means the Pleistocene deposits we have in Peninsular India are of no consequence for the purpose of determining their chronology in comparison with such deposits in the north. For this reason, ZEUNER (1950) had dated the Indian Acheulian to late Riss or beginning of the Last Interglacial on the basis of typology rather than by a study of stratigraphy. Unfortunately for us, the pollen grains in these deposits are not preserved. A set of 48 samples collected from the fossil soil horizons on the lower Narmada from different points showed complete absence of pollen grains (This study was kindly undertaken by M. Ph. GUINIT of the Palynology Laboratory of the Institute Francais at Pondicherry, on behalf of the M. S. University of Baroda).

In this connection, the following observations might be interesting. Holocene has been an interglacial period, marked by temperate climate in the north. But in India we see in this period a more humid condition than that which prevailed before it, that is, the period of Last Glaciation. The formation of humus-rich, fertile black cotton soil, is a feature of the Postglacial period in India. During this period rivers have been eroding, indicating greater precipitation. In contrast to this humid condition in the Holocene, the period that immediately preceded the present, was less humid in Penisular India. This is amply indicated by the thick silty deposits, (U and Z of ZEUNER, on the Hirpura section of the Sabarmati) on the Narmada, the Mahi, the Burhabaland, the Rihand etc. This thick eolian and river-borne silty deposit is considered contemporary with the later phase of the Upper Pleistocene by ZEUNER (1963).

Preceding this dry phase was a more humid phase indicated by the heavy weathering of the silt, the phase T of ZEUNER, on the Hirpura section on the Sabarmati, the main soil observed on the Narmada, downstream from Ambali and the main soil observed on the Mahi at Dabka, Vasad, etc. Preceding this we: climatic condition was a dry phase indicated by a thick silty deposit in the rivers: the Sabarmati (the phase ST of ZEUNER), the Narmada, the Mahi, etc. This

phase, in its turn was preceded by a more humid condition for which we have the indication in the form of Early Stone Age implementiferous cemented gravel on all these river sections. This phase in its turn was preceded by a drier climatic condition indicated by the layer of mottled clay which in its turn was preceded by a wet climate, indicated by the presence of allitic weathering and the formation olateritic crusts, observed on the Narmada.

If as is indicated by the present condition, an interglacial period of the north is a period of more precipitation in the tropical regions and the Last Glacial period of the north was a dry climatic period, it follows that, in the tropical region a more wet climatic condition prevailed during the interglacial periods and a drier climate, during the glacial periods.

Should this suggestion hold itself, we will be in a position to correlate the tropical Pleistocene deposits with those in the north and hence can date them as well as their associated tools.

1. The black cotton soil, regur, (Z) is a feature of the Holocene. As is indicated by ZEUNER (1963), probably precipitation was heavier during the early stage of Holocene. Contemporary with this heavy precipitation phase was the formation of the regur on the Deccan Plateau and the other soils elsewhere.

2. The formation of over 9 m. thick silty deposit (UZ) was contemporary with Wurm. This Last Glacial period in the north was punctuated by two interstadials. It is but interesting to note in this connection that our study of Pleistocene deposits on the Lower Narmada has brought to light two fossil soils in this silty deposit, about 2 m. to 3 m. apart, the top one about 35 cm. thick, the lower one 45-50 cm. thick. This would indicate that the interstadials of the north also manifested themselves in the form of heavier preciptation in the tropical region.

3. The red soil formation (T) was contemporary with the Last Interglacial. Apart from Sabarmati, this heavy weathering and soil formation is also observed on the Mahi and the lower Narmada, as thick as 3 m. or more. On the Narmada, this soil is observed downstream from Ambali, overlying the lower series which form the 'C' horizon of this soil. However, this soil is not seen to overlie the upper gravel at Kanjetta, from where the disappearance of the upper gravel begins, or beyond, upstream.

Nevertheless, it is quite probable that the upper gravel at Kanjetta, Chandod and beyond, upstream correspond to this soil. This gravel phase is the chief source of the Middle Stone Age tools.

4. The formation of the silt phase (ST) below the above red weathering was contemporary with Riss.

5. The formation of the Early Stone Age implementiferous cemented gravel was contemporary with the Great Interglacial period.

6. The formation of the mottled clay was contemporary with Mindel, and that of lateritic crust with the First Glacial.

It is but pertinent to ask, why should there be more rainfall during the interglacials and less during the glacials in the tropical regions? Has the heavy precipitation in the north during the glaciation any thing to do with diverting or rende-

ring static the monsools winds of the tropics? Or are the monsoons more active during the interglacian and less during the glacials? Whatever that be, our present day climatic conditious and the evidence regarding the climatic conditions that preceded the present geological era, themselves suggests that the interglacial periods were more wet in the tropics and the glacial periods were drier.

V. N. Misra :

From a perusal of the recent literature on the subject it appears that although workers in the field carefully describe the various deposits in river sections, they rarely mention the disconformities or erosional features. But it is hardly possible that the passage from a coarse pebbly deposit to a silt can be a smooth transition. The very fact that the two deposits are so distinct in composition and are the result of very different climatic conditions means they must be separated from each other in time by a fairly long interval. Thus the climatic and stratigraphic conclusions arrived at from studies in which only aggradational phenomena have been noted cannot be correct. It is no doubt more difficult to observe erosional phenomena than the aggradational ones simply because the latter are conspicuous by their presence whereas the former are to be known largely by inference. But for obtaining a correct picture of Pleistocene stratigraphy and climate both are of equal significance.

It is now generally agreed that there are two cycles of aggradation in the Peninsular rivers. My observations in Rajasthan where I have been working for some years show that in eastern Rajasthan two aggradational cycles are present particularly in river Wagan, a tributary of the Berach in Chitorgarh district. However, in western Rajasthan in the valleys of the Luni and its tributaries I have found evidence only for one cycle. The sequence of deposits here from bottom upwards is (1) whitish clay, (2) sandy gravel, (3) silt, and (4) wind-blown sand. The Palaeolithic industry found in this region is broadly similar to the Nevasian of the Deccan and Central India and is associated with the cemented gravel deposit. There is no evidence of a Madrasian culture. A few handaxes found in the area belong to the Luni Palaeolithic culture because on the basis of raw material, technique and size they are indistinguishable from other tools of this culture.

K. V. Soundara Rajan :

The recent work on Pleistocene stratigraphy of India emphasises the possibilities of climatic difference from region to region based upon soil data. A study on these lines was initiated by Dr. Zeuner in Gujarat on the one hand and a number of sites, on a tentative footing, in the Deccan. It is very essential that the stratigraphic data of Early Stone Age sites should be complete, particularly, in respect of the sequences of the deposits with or without a disconformity and the nature of the tool types associated actually with the strata. It is obvious in this connection that small sections sporadically recorded would not by themselves establish climatic sequences and it is necessary that one and the same river system should be tackled at a number of places and its terrace system, if any, noted carefully

on a longitudinal profile. In many cases, it is possible that only a vertical section is available and the 'terraces' are no more than mere morphological benches, without either artifactual or stratigraphic features.

In India, the particular feature of the Early Stone Age in relation to the Middle and Late Stone Ages would seem to be the great expansive duration of the Early Stone Age, thereby calling for a critical appraisal of the climatic changes that could have taken place within the range of the Early Stone Age itself. It would be necessary to have independant methods by which cross-checking of stratigraphic and soil data are made possible. In this regard it would be very useful to co-ordinate our work with that of the explorations of the Geological Survey, particularly, through its Oil and Natural Gas Commission by which stratigraphic charts of deep borings from different places are available to us. It may be mentioned here that the information provided by one such boring from the Cambay region of Gujarat indicated two gravel conglomerates within the Pleistocene, one earlier at about the middle and the other later towards the close. This cross-checked reasonably with the evidence shown by a Middle Stone Age site at Kapadvanj in Kaira District of Gujarat discovered by the writer, wherein a gravel terrace approximately about 5 to 7 m. above the flood plain of the river Mohor (forming part of the Sabarmati system) gave Middle Stone Age tools but was not preceded by any earlier gravel in that river valley. This gravel was succeeded by a silt and loess deposit of considerable thickness on top of which microlithic tools were available as elsewhere in Gujarat.

Laterites have been another contentious factor in Indian Pleistocene stratigraphy, since the association of detrital laterites with certain tool industries, as in Madras area around Attirampakkam and elsewhere in the Karnatak and Orissa, gave rise to the need for a better understanding of the very nature of the formation of laterites, both primary and secondary. In the case of Narmada DE TERRA's section shows laterites as unconformably underlying the stratigraphic section well below the lowest gravel. It is, however, to be borne in mind that it was not a regular sequence but a composite one. Even so, a better understanding of the laterites underneath the Stone Age stratigraphy would definitedly give us a better idea of the climatic environment. It is taken that laterites are sometimes forming even today under damp conditions of excessive variations between maximum and minimum temperatures. But the formation of a heavy lateritic encrustation of the typical vesicular and mammiform structure and its subsequent removal as secondary deposit, when underlying a Stone Age sequence will be a truly valuable information, despite its detrital nature and will considerably help in climatic zonation.

The attempt to link up the Pleistocene glacial sequence of the Potwar with that of the Siwaliks in the Punjab in the Kangra valley has not been successful yet. We must persevere to produce a relative sequence, since it would help us to relate the inland stratigraphy and tool sequence better and would incidentally permit the exact delimitation of the periglacial tract.

S. P. Gupta :

The formation of the thick deposits of secondary laterite on many sites of eastern coast in south India and its relationship with Early Stone Age industries has often been taken as sheet anchor by earlier writers. KRISHNASWAMI had written about the pre-lateritic Abbevillio-Acheulian tools in the Madras region. ZEUNER had collected a few tools of this type from within the lateritic deposit at Pondi a site near Attirampakkam in Madras State. They were weathered and not merely stained red. Post-lateritic tools found at the same place were extremely fresh and belonged to late Acheulian tradition.

Now the question is : Can we at all date the formation of these thick deposits independent of the associated tools? Recent studies on probably similar deposits at Birbhanpur by Dr. B. B. LAL have also not thrown any definite light on this problem. However, it appears that its formation implies heavy erosion, apart from the yearly erosion. This may indicate a period of pluvial conditions. Roughly it appears to have taken place during the Late Pleistocene on the basis of tools found in these deposits but the approach is illogical.

Gudrun Karve-Corvinus :

In the present report I would like to put before you some of my observations on the stratigraphy of Pleistocene river deposits. My work consisted mainly of the survey of Pravara river. In addition to it I collected data from the rivers Sabarmati, Narmada, and Godavari. The work was done during the last two winter seasons and it is yet to be completed.

On Pravara, two older phases of Pleistocene river deposits can be distinguished, an older alluvium and a younger one, the deposits of which lie one on top of the other. The sediments of the youngest alluvium are seen resting against the former. This is as far as I could see the general picture of the rivers of Peninsular India. The deposits of the two older phases, of which generally only the upper part can be seen on the cliffs at the river, form the higher terrace, which has a height of about 6-8 m. in the lower tract of the river near Nevasa and a height of about 20 m. in the upstream part near Vite. The youngest alluvium forms a second lower and much smaller terrace. These two terraces are the only distinct terraces and no other terraces can be seen.

After the first filling of the river valley we generally presume an extensive erosional phase in the course of which most of the sediments of the first filling were carried away. Only at the bottom and at the edges of the valley at sheltered places can the remains of the first filling be expected. They are buried under the deposits of the next phase, so that we rarely come across them. Yet it is still to be verified whether they were really eroded away during an erosional period or whether they are only a thin deposit with no unconformity towards the overlying younger gravels and silts.

The next aggradational phase must have been a very extensive one. Thick deposits of silts and gravels were laid down. After this period the river never again reached the height of these deposits. The terrace formed by these silts and gravels

i. e. the higher terrace, is a very distinct and pronounced one, now mostly covered with black soil. The deposits consist of thick layers of silts, intercalated with many crossbedded gravels, which always appear as pockets, but never occur in continuous layers. The silts are of a light yellowish grey to brown colour. They are generally full of kankar, even in the hills. Layers of fine sand alternate with those of very fine loess like material and also with layers of a more clayey, sticky silt, which breaks up into angular sections while drying. Though from a greater distance the silts seem to be of a very homogenous facies, which leads to wrong interpretations, one observes at a close examination a distinct stratification. The gravels, which were described above to be occurring in pockets or lenses are nothing but the same deposit consisting of coarser material intercalated in the finer material. In other words the gravels do not form a stratigraphically different horizon.

With this we come to a problem which has been discussed so often. We always speak of phases or cycles in the sense that a lower gravel deposit would indicate a humid climate on the verge of a drier climate and an upper silt deposit would indicate increasing aridity :

Silt............dry, increasing aridity }
Gravel............humid, decreasing humidity } one cycle.

And when we find another gravel lying on top of the silt we immediately take it to be a sign of another cycle. It is said that the river after the climax of a wet phase begins to lay down first the heavy load, i.e. coarse gravel, followed by finer gravel, sand and finally the silt. This would certainly be the case if there were such gradual climatic changes. But, in fact, such a theory does not explain the mode of sedimentation which is seen in the sections mentioned above. The whole sequence of gravels and silts seems to be of one deposit, indicating no distinct drastic climatic changes at all. The finest example of this intercalating sedimentation of gravels and silts can be seen at the construction site of a dam near Rahuri on the river Mula, a tributary of the Pravara. Here the higher terrace has been cut down in a long longitudinal sections across the valley down to the bedrock. The whole section is about 35 to 40 m. thick and it comprises light kankarized silts with numerous thick lenses of gravels. No distinct unconformity could be traced.

The same observation can be made on the Narmada (at Devakachhar on the Umer tributary) and at Hirdaipur on Shakkar (a tributary of Narmada) and on the Sabarmati. The "Silt Phase" (S) described by Zeuner (1950) at Hirpura on the Sabarmati is in reality a succession of cemented gravels and silts. The same can be said of the upper yellow-brown series, Zeuner's "Main Dry Phase" (U), which too comprises intercalating yellow more sandy silts and fine gravels.

In order to explain these points, the whole older alluvium should be studied from a different aspect than done up till now, and I would like to suggest that they should be compared with the conditions of the river activities of today. We have to ask under what conditions the deposits have been laid down if not by drastic climatic changes, and how much time the process needed. Why should

it not be possible that the sediments were laid down at times of big floods? A monsoonal climate gives ample opportunity for such floods and a monsoon climate is to be presumed for the Pleistocene in Peninsular India. If we compare the river activities of today with those of the Pleistocene we will find many parallels. In the recent river beds we come across big pockets of gravels and sands in the inner sides of the meanders and silty layers in the parts of the river bed where the monsoonal flood water had less velocity. Cross-bedding is common today as it was in the past.

For understanding the conditions of sedimentation of the former times it should be interesting to study the existing conditions. One or several rivers should be observed over a number of monsoons, their erosional and aggradational activities should be studied and exact measurements of strata should be taken at some predetermined places. What I mean to say is that we do not have to presume drastic climatic changes in order to explain the genesis of the gravel-silt successions. A semi-arid climate as that of today with periodical floods would give us explanations enough. That means that every year the river would experience an erosional flood time, an aggradational phase after the floods and a long time during which there is neither too much erosion nor any considerable deposition, but during which heavy weathering and colluvial erosion takes place on the bare, rocky hills, which bear hardly any vegetation and where the material gathers and waits for transport during the next monsoon period. Apart from times of heavy floods, which occurred periodically after uncertain lapses of time, during which thick deposits were laid down, the river shows normal monsoonal activity.

One of the problematic structures of the upper part of the river is the boulder beds. These are cemented beds of very coarse materials. They are generally unstratified, unsorted, containing pebbles of all sizes and of all grades of rounding. Generally, we are inclined to interpret them as the oldest gravel, whenever we find them exposed in the river bed as hard ledges or platforms. But this would be wrong interpretation in most cases. The river is still in a young stage in the upper course and the nullah brings every year much eroded material from the nearby hills,—coarse, subangular gravel, boulders, disintegrated angular trap etc. and deposits them in the river bed. Such boulder deposition is going on even now. In front of every knick-point we see extensive recent boulder beds.

The question is that of the determination of the age of these cemented coarse gravels. Are they really a part of the oldest alluvium or they are only the lower part of the younger alluvium ? Dr. SANKALIA told me that he had seen old bouldery gravel at several places on the upper part of Pravara (e. g. near Vite). I too have seen these–in fact they are not rare–and I am convinced that they are only a coarse part of the upper finer gravel. The difficulty arises from the fact that we rarely find them underlying any other deposits. When they are cemented they form a platform and the overlying softer material is eroded away. However, at a few places on the Pravara and Mula I have seen them underlying, quite conformably, the fine cross-bedded gravels of the younger alluvium. If this

is true there is no unconformity between them, it would mean that the boulder gravels belong as a lower and more bouldery part to the upper gravels, i. e. to the Series II bearing gravels. Not a single palaeolith has been found within the boulder beds of the upper Pravara.

These observations indicate that the boulder beds are not necessarily the chronologically oldest gravels, but that they are formed at all times if proper conditions are present. The fact that the boulder gravel is bouldery and hard-cemented and lies at the bottom should not be the only criterion by which it may be called old.

A further comment which I would like to make in this connection deals with the method of investigation. If we do not find tools and fossils in plenty, it is extremely difficult to say anything about the age of the deposits. A solely superficial study with scanty finds of tools and fossils may lead us and has often led us to very wrong interpretations. Such investigations should therefore be supplemented by extensive and exact excavations at promising sites. As far as possible no surface finds should be taken into consideration and those finds which occur *in situ* in the excavations should be studied statistically.

NOTES

1. Recently the Krishna basin has also yielded fossils along with the tools as reported by the staff of the Deccan College.

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MIDDLE STONE AGE CULTURE IN INDIA AND PAKISTAN

H. D. SANKALIA

The discovery of a distinct Stone Age period in the Indo-Pakistan subcontinent, with characteristic tools, faunal assemblages, river deposits, and inferred climatic conditions, is comparatively recent. Such a period was first recognized not more than a decade ago. The age and its artifacts cover the period between the Early and Late stone ages—that is, from approximately the end of the Middle Pleistocene to the beginning, or even into the early part, of the Holocene.

The discovery was in a sense the natural consequence of an organized search for man's early beginnings and subsequent development in India. Until 1930, some two stone ages were discernible in India. These were the Palaeolithic and Neolithic. The latter included the microliths, though as early as 1906 LOGAN had designated the period that intervened between these two stone ages the "Mesolithic". However, this classification into Palaeolithic and Neolithic, proposed by Robert Bruce FOOTE (1914 and 1916) who tried to arrange his discoveries of stone tools and pottery from several parts of India in some sort of chronological order, had become current. FOOTE's attempt at classification was soon followed by that of Coggin BROWN (1917), who dealt with a few Copper Age tools and weapons as well as Stone Age objects. However, no steps were taken to put this knowledge on a proper foundation, as LOGAN had urged and as FOOTE had tried to do. Even the discovery, in 1920, of the great Indus Civilization (later called Harappan) did not enkindle a desire to search for its antecedents, which lay in the last phase of the stone ages. Miles BURKITT (1930, 327) then came forward with his classification, into four series, of tools collected by CAMMIADE from the south-east coast of India. The series were not specifically named, but it was definitely understood that the tools in series I were earlier than the rest, and that those in Series 4 were the most recent. BURKITT further tried to correlate the series with certain climatic phases and corresponding soil formations on the east coast, with particular reference to Africa. DE TERRA and PATERSON's (1939) well-organized researches in the Kashmir Valley and adjacent foothills of the Himalayas lying partly in what is now West Pakistan brought to light stratified stone age industries. These were named, respectively, Pre-Soan, Early Soan, and Late Soan. It is now felt that the Late Soan can well be included in the Middle Stone Age (ALLCHIN, 1959, 1-36; 1963, 214 and 219).

DE TERRA and PATERSON also referred to, and illustrated, a flake-and-blade assemblage from Sukkur and Rohri in Sind, West Pakistan, roughly assigning it to a Late Stone Age period, and they vaguely mentioned, without describing or illustrating it, a proto-Neolithic industry (1939, 308-320; SANKALIA, 1962-63, 122) from the Narmada Valley.

Just at this time, TODD (1946, 257) published a short account of his discoveries near Bombay, which, because of the wide span of the periods covered by the deposits (in spite of their limited thickness) and because of the variety of the industries, soon became a classic.

In 1943, after my co-workers and I had investigated the Sabarmati Valley and other river valleys of Gujarat (SANKALIA, 1946), I began a search in the Deccan (Maharashtra), where no search for Stone Age tools had been previously made because the region was believed to have been unfavourable as habitat for Stone Age man (FOOTE, 1916, 41). Here at Nandur Madhmeshwar in the Godavari Valley we found points, scrapers, and simple flakes on fine-grained, chalcedonic material from well-stratified gravel deposits (SANKALIA, 1943). But this assemblage was quite different from assemblages I had previously investigated in Gujarat. Since its significance was not known, no further search was made at the time. Then, in 1954, we found exactly similar tools, in large numbers, at Nevasa (SANKALIA, 1956) on the river Pravara, a tributary of the Godavari. Here we also found handaxes, cleavers, choppers, and chopping tools on a fine-grained variety of basalt, occurring as dykes in the Deccan lavas. Since these two industries, differing markedly in type and depending on different raw materials, are stratigraphically separated as well, provisionally I called the handaxe assemblage series 1 and the point-scraper series 2. Still another assemblage, from the surface and consisting of long whitish chalcedonic blades, I called series 3.

GEOGRAPHICAL EXTENT OF THE MIDDLE STONE AGE CULTURE

With the clues supplied by the stratigraphy and tool typology at Nevasa, it soon became apparent that similar successions of industries could be found in many parts of India. Systematic searches by my students and colleagues, a few members of the Archaeological Survey of India, and other scholars have, to date, revealed such stone assemblages in many regions. These include districts of Maharashtra; (*I. A. R.* 1956–57, 11; 1957–58, 24; 1958–59, 21; 1959–60, 28; 1960–61, 19, 22; SANKALIA, 1962–63, 108), (though not the coastal district of Ratnagiri), northern Mysore (or Karnatak) (SANKALIA, 1956–57 and BANERJEE, 1957) Andhra (ISAAC, 1960)[1], Madras[2], Orissa (MOHAPATRA, 1962) southern Uttar Pradesh[3], Madhya Pradesh (KHATRI, 1958, 1961, 1962, and 1963)[4], East Punjab[5], eastern[6] and western (MISRA, 1961, 1962) Rajasthan (in western Rajasthan these assemblages seem to represent the earliest industry, according to MISRA's study) (1961, 1962), and Peninsular Gujarat or Saurashtra (SANKALIA, 1962–63). Kerala, Assam, West Bengal, northern Gujarat[37] and Kashmir valley proper have not yet been explored from this point of view, but it is clear, nevertheless, that this Middle Stone Age culture has a very wide distribution as wide as that of the Early Stone Age culture. Moreover, owing to the availability of the raw material and the comparative smallness of the tools, as well as to their character, the Middle Stone Age tools appear in greater profusion than the earlier artifacts.

There has been some difference of opinion concerning the designation of this Stone Age industry. Many field workers began to call similar finds, very often unstratified " series 2 ", in accordance with my terminology (SANKALIA, 1956). But in every case, the horizon of the tools was not known. Secondly, in a vast country like India there are bound to be regional variations attributable to ecological, geographical, and other factors. So, with a view to including all the stratified and unstratified but typologically similar-looking assemblages, some scholars (SUBBARAO, 1958) proposed the name " Indian Middle Stone Age ", and this name was provisionally accepted by the First Asian Conference on Archaeology, which met in New Delhi in 1961 (SANKALIA, 1962–63, pl. XV).

I myself preferred the term " Middle Palaeolithic " (1962-63, 74) at least for those areas and assemblages where the occurrence of these tools could be definitely assigned to the second wet-and-dry cycle in the Peninsular rivers and where the tools were in all respects identical with those found at Nevasa and elsewhere in Maharashtra. Nevertheless, I accept the new terminology for the sake of avoiding confusion in nomenclature. Recently MISRA (1962) has advanced new and solid reasons for preferring the terms " Early " and " Middle Palaeolithic ".

The Indian Middle Stone Age culture, as it is known at the moment, has the following components and characteristics.

1. Stratified industries of scrapers, borers, and points on flakes and flake-like nodules from Nevasa and other sites in Peninsular India, Rajasthan, south Uttar Pradesh, and Orissa.

2. The Late Soan industry from West Punjab, Pakistan.

3. An industry from Sangav Cave near Peshawar, West Punjab, Pakistan, recently excavated by A. H. DANI[8].

4. An industry from East Punjab recently discovered by G. C. MOHAPATRA.

5. Unstratified collections from several other parts of India, Adilabad (ALLCHIN, 1959), Nalgonda district (ISAAC, 1960), Salvadgi[9], Bijapur district, and sites on the upper Soan in the Sidhi and Shahdol districts[10] which are typologically similar to the Nevasian (the industry from Nevasa).

Component 2 (the Late Soan industry) has been described and illustrated by DE TERRA and PATERSON (1939); the collections that comprise component 5 are unstratified; and DANI's cave material (component 3) and MOHAPATRA's recent East Punjab discoveries (component 4) have not yet been published. Thus, in this article I discuss only component 1 in any detail.

At the type site Nevasa (SANKALIA, 1960, 39) and at Belpandhari, Kalegaon, and Nandur Madhmeshwar (SANKALIA, 1943) on the river Godavari, comparatively small tools (points, borers or awls, and scrapers of various types) of a fine-grained chalcedonic material, as well as chert and jasper, occur in fairly well stratified gravels These. gravels appear greyish white

when freshly exposed but on weathering they look dark grey and might be mistaken for basaltic rock itself. In constitution the gravel is more sandy than pebbly and contains nodules of secondary minerals such as jasper, chalcedony, chert, and zeolite, but rarely large pebbles of basalt. Cross-bedding is common.

This description applies to all the areas where the principal rock formation is of basalt (in Maharashtra) (*I. A. R.*), Saurashtra (SANKALIA, 1962-63), and parts of Madhya Pradesh (SANKALIA, 1958). In Kurnool (Andhra) (CAMMIADE and BURKITT, 1930; ISAAC, 1960), Bellary (Mysore) (JOSHI, 1955,) western Rajasthan (MISRA, 1961); Orissa (MOHAPATRA, 1962), the gravels vary in detailed composition and colour, for these characteristics depend upon the parent rocks, but their sandy character remains unmistakable.

Superficially this gravel seems to (and in some cases actually does) overlie the older deposits, which consists of a coarser gravel, breccia and pebbles of basalt, dolerite, and other material, and observation of numerous sections in several rivers of Peninsular India has convinced me that the stratigraphical position is not as it appears, but is as follows.

STRATIGRAPHICAL POSITION

All the major Peninsular rivers (except the Narmada) deposited, after their initial formation, a thick layer of coarse gravel and silt. This is generally 9 to 12 meters thick. (In the Narmada it reaches a height of 24 m.) (SANKALIA 1962–63). The gravels of this phase contain a handaxe-cleaver industry of Acheulian type. For some reason—perhaps because of tectonic disturbances, the change of sea level, climatic changes, or a combination of such events—this deposit, laid down during a wet-and-dry phase, was cut, at times upto the bed rock. Then, during the next cycle, the rivers again filled up the river bed, but rarely did they reach the same height as before. Hence, the new deposit does not overlie the earlier deposit but lies against it, thus reducing the size of the river valley. (This fact was noticed by DE TERRA and mentioned by him in discussing the stratigraphy of the Narmada Valley.) Normally this phenomenon results in the formation of two distinct terraces, a higher and older one, and a lower and younger one. At many places the deposits do not appear as distinct terraces, but the older deposit is partly or wholly eroded and its place is taken by the younger deposit. Or very often the second deposit lies completely eroded, and its gravel lies in the river bed. However, at a few sites I have been able to detect the terraces or all the deposits, and at others, the gravel of the second cycle, or its silt, resting clearly against the older silt (which is weathered reddish). Saguna Ghat, in Narsinghpur District, and Dattawadi, in Poona District, are examples of sites where all the terraces may be seen.

At Saguna Ghat the Narmada has exposed three terraces at heights of approximately 21, 12 and 3 meters. The lowest one is recent–the present flood plain. The middle one has a thick, well-cemented gravel bed at its base. This terrace rises here to a height of 4½ to 6 meters and contains both fossils and implements. This is the principal horizon of Middle Stone Age tools of Nevasian type (SANKALIA, 1946)[10]

Elsewhere in the basaltic regions the same type of gravel bed forms the base of a low terrace. Noteworthy sites are Belpandhari and Nandur Madhmeshwar (SANKALIA, 1943) on the Godavari, Jetpur on the Bhadar in Saurashtra, and a site on the river Wagan in Chitorgarh District. Many other such sites have been reported, but I have not myself seen them.

Poona provides the best example of such a site. At Dattawadi on the right bank of the Mutha, coarse and pebbly, at times even bouldery, gravel is exposed for nearly 1½ kilometers. It is overlain by a thick deposit of silt, now weathered brownish red and full of lime concretions. It appears that at places both the gravel and the silt were wholly or partially cut away during the first erosion and later replaced by a finer gravel and a greyish silt, which does not reach to the height of the older deposit but rests against it. Because all four deposits are juxtaposed and the colour differentiation between the two gravels and the corresponding silt is very marked, a reliable picture of the various climatic cycles and the river mechanism can be reconstructed.

In the still older land mass formed by granite, gneiss, and quatzites, now exposed in Kurnool and Chittoor districts (Andhra), in Belgaum, Bijapur, Bellary and Dharwar districts (Mysore), and in Chingleput district (Madras), the gravels of this phase appear brownish, pellety, and loosely cemented. Well-exposed sections may be seen at Tandrepadu, opposite the town of Kurnool on the Tungabhadra, at Krishnapuram on the Bhavanasi, at Chintpalli on the Tigaleru, and at Vadamadurai on the Arani.

Thus one may postulate certain climatic or environmental factors which brought about the deposition and erosion of these gravels and silts all over Peninsular India.

Except for deposits in the Narmada Valley (where one finds three such distinct cycles instead of two) and in the Luni Valley, western Rajasthan (where one finds only one such cycle), one may tentatively regard these deposits as not only homotaxial but even contemporary, though before one can say definitely that they are, more positive data, based on intensive and more scientific and detailed study of each major river valley, are needed. Hence the present correlation, based on stratigraphic position of the gravels, their composition, and the tools they contain, should be regarded as strictly provisional.

PRINCIPAL TOOL TYPES

The industries of this culture comprise the following types of tools.

1. Scrapers of various types on (i) simple flakes, (ii) flakes with prepared platform, (iii) flakes with prepared platform and from prepared cores, and (iv) simple flat nodules : hollow or concave; convex, concavo-convex, side, on square, rectangular, or crescentic flakes

2. Borers or awls on material similar to that described for type 1.

3. Points on material similar to that described for type 1.

4. Scraper-borers, on material similar to that described for type 1.
5. Blade-like thick flakes (here called 'flake knives') square, rectangular, or crescentic.
6. Choppers.
7. Small Acheulian-type handaxes or bifaces of jasper, flint, and other fine-grained rocks

These tool types are associated with three kinds of cores : (i) amorphous, with deep flake scars; (ii) discoidal, with deep or flattish flake scars, or both (iii) core showing previous preparation of the platform; (iv) " tortoise " cores, from which one flake is taken out, showing previous preparation of the core.

The nature of the flakes has been indicated, but I must emphasize again that most of the flakes in any collection that I have seen are of the unprepared type, showing a bulb (sometimes quite prominent) and a flat platform at an angle. Flakes with prepared platform and flakes also showing work on the back as in true Levalloisian flakes are indeed few.

No genuine burins or gravers and fluted cores have yet been found in a stratified deposit of this period, though some writers (MOHAPATRA, 1962 and KHATRI, 1962) have included such tool types in their lists of Middle Stone Age tools.

Thus, from a study of the cores and a large number of flakes in any collection, it may be said that prepared core and discoid core techniques and the stone hammer were used for the removal of flakes. However, the one concern of the maker was to have a flake, or even a nodule, with a flattish surface so that he could convert it into a point, a borer, or a scraper, with minimum retouch; he often left the main part of the material completely untouched, sometimes even with uneven cortex. Thus, though the flakes are in a majority in any collection, and the Middle Stone Age industry or culture might be designated a " flake culture " still it should be pointed out that the flake was not a prerequisite, as possibly it was in other flake cultures, like the Clactonian and the Levalloisian. Likewise, the retouch on scrapers, points, and borers, and on occasional tanged specimens, is neither regular nor definite, though it is at times quite fine, and the specimen, with its symmetrical outline, can be a thing of beauty. Undoubtedly Middle Stone Age man in India could produce an artistic tool which occasionally shows definite traces of an incipient tang.

It may be seen that the large handaxes, cleavers, choppers, chopping tools, and scrapers which characterize the Early Stone Age, and the tiny lunates, trapezes, and backed blades of pen-knife type, as well as the genuine fluted cores, which are features of the Late Stone Age, do not figure in these Middle Stone Age industries. There are, no doubt, some scrapers on thick crescentic flakes, but these are quite different typologically from the thin lunates of the Late Stone Age.

FUNCTION OF TOOLS

What did Middle Stone Age man do with these tools ? Their function can only be guessed.[11] The straight-edged scrapers may have been used for dressing skins and barks of trees; the hollow or concave scrapers, for smoothing the hafts of spear or arrow-heads (?); the knives, for cutting and chopping; and the pointed tools, for piercing (in wood, bone, and soft stone (?). It may therefore be inferred that at this period there were larger tools and weapons of more perishable materials, such as bone and wood (Clark, 1960; Zeuner 1963, p. 21), in the preparation of which these small tools were used. That many of these small tools, including scrapers, were hafted in a primitive way is obvious from the presence of small tangs on points, borers, and scrapers, made by notches and occasionally by retouching of concavities.

Since the gravels and silts are permeable to air and water, no pollen grains could survive in them, on account of oxidizing environments. So no true idea of the vegetational environment is likely to be had. It no doubt varied from one major geographical region to another, as it does today; still, on the whole, it may be said that Middle Stone Age man, wherever his tools have been found in abundance, lived in lightly forested regions where game was readily available and where there was water close by, in the form of a lake or river. In the basaltic regions he no doubt preferred the foothills, for here raw material in the form of veins of agate, chalcedony, quartz, and jasper was close at hand. I have seen many " workshops " around Poona, at Choli and Dongargaon near Maheshwar on the Narmada, at Mandasor on the Shivna, and at Dhaneri, Pali district, Rajasthan. At Choli a mottled and banded jasper occurs in the form of huge outcrops. The area is strewn with thousands of cores of all sizes, but, among these finished tools are few. At Dhaneri limestone outcrops run in a chain for nearly 65 kilometers. The whole area is full of nodules of chert and flint, from which Misra (1961 ; 1962) collected his tools. Findings at Salvadgi on the Krishna, Bijapur district, Mysore, are similar.

CLIMATE

The climatic conditions, too, have to be inferred from the nature of the deposits. Wherever deposits of all four types—the gravels and silts of the first and second cycles—are juxtaposed (for instance, at two sites on the Mutha at Poona, at sites on the Pravara beyond Akola, at Maheshwar on the Narmada, at Nittur on the Tungabhadra, at the junction of two small rivers near Renigunta, and at Vadamadurai on the Arani), marked differences in the colour and composition of the gravels and silts are seen. The first or earliest gravel has large pebbles, even boulders and angular slabs, of basalt and dolerite (at Maheshwar, beautifully rounded pebbles of quartzite); it has weathered to a reddish colour and is full of lime concretions, owing to leaching. On the other hand, the second gravel (at Maheshwar, this is the third) is, except for the redeposited material, greyish, sandy, and marked by cross-bedding. The silt which overlies it and rests against the older deposits is darkish or whitish grey and comparatively less full of lime concretions. The climatic conditions which brought about these marked differences must

have been different; pending laboratory tests, these changes in the deposits may be attributed to a cycle of heavy wet phase followed by a drier phase. This cycle was followed, in turn, by a lighter wet phase, during which subaerial denundation of the surrounding hills, as we see it today, began; the resultant mass of sandy gravel was carried to the river, which in turn aggraded gradually as the climate became drier. Over this gravel was deposited a fairly thick layer of darkish or whitish silt, when the river remained sluggish for some time.

In such an environment—not very humid and not thickly wooded—*Bos namadicus Falconer* (or *Lydekker*) and even *Elephas antiquus*, which have hitherto been regarded as characteristic Middle Pleistocene fauna, seem to have flourished and to have served as game for Middle Stone Age man. ANSARI and myself (SANKALIA, 1962-63) found a complete skull of *Bos namadicus Falconer* (or *Lydekker*)[12] with the upper jaw and horns, deeply embedded in the gravels at Kalegaon on the Godavari. These gravels are rich in tools, and a few tools were found in the ox's skull itself. Recently my colleagues G. G. MUJUMDAR and S. N. RAJGURU discovered the remains of an elephant tusk at Chandoli, near Poona. We have collected a large number of fossils from fields, thinly overlain with silt, near Devakachhar, and we extracted another fossil from the highly cemented gravels at Saguna Ghat on the Narmada. Many more fossils have been previously recovered from this area. All these await scientific identification.

This Middle Stone Age culture (if it be permissible to call the industry by this more comprehensive term), like its predecessor the Early Stone Age culture, has been inadequately known and dated. The presence of a fauna hitherto regarded as typically Middle Pleistocene in gravels which belong to terrace 2 or 3 in Peninsular India, as well as the occurrence in some regions (western Rajasthan, Madhya Pradesh, Andhra, Maharashtra) of small handaxes, suggests a relationship of this period and its few industrial elements with the Early Stone Age and its artifacts[13]. However, the typical flake nature of the Middle Stone Age industry and the use of a totally new raw material, which is invariably silicious and fine-grained, implies the arrival or existence of different cultural forces. It is these which give an individuality to the culture and which seem to have given rise, later, to the microlithic industries, again all over India. However, it must be emphasized that such a course of development is nowhere stratigraphically documented (probably because not much work has been done). It is therefore premature to seek affinities between the Middle Stone Age culture and African (including the Egyptian) or European stone age cultures.[14]

SUMMARY

For the present we may only note (i) the special features of this flake culture[15] consisting predominantly of scrapers, points, and borers on any fine-grained material, (ii) its relationship to certain river deposits and factory sites on or near foothills, and (iii) its distribution over almost the whole of Peninsular India. Its maker, Middle Stone Age man, and his vegetational environment are unknown, though we do have a faint idea of the contemporary fauna.

COMMENTS

K. V. Soundara Rajan :

The Middle Stone Age cultures in India have in recent times become considerably expanded in their lithic range and provenance, thanks to the research undertaken by a large body of men from universities and other learned institutions. At the same time, we do not seem to have yet any precise idea about the exact nature of the environmental changes which resulted in large cores and core tools being given up, and flake cultures dominating. In the Deccan and elsewhere in the trap areas, it has been found that the Middle Stone Age tools—called often as Series II—are made of siliceous minerals like agate, chert, jasper and chalcedony. The tools themselves are comparatively much smaller than those of the Early Stone Age as represented in the Acheulian complex. It has been contended by KHATRI that the Middle Stone Age tools are the handiwork of a new wave of people inhabiting these areas. However, the nature of the stratigraphy by which Acheulian tools and Middle Stone Age flakes appear to have been found side by side on the top of the second gravel of the Narmada, together with the nature of occurrence of fossil fauna like *Bos Namadicus*—(*Falconer*) in the gravels of Godavari, Narmada, etc., both in the Early Stone Age and continuing in the gravels of the Middle Stone Age, would seem to show an essentially gradual ecological change and a cultural continuum. Of course, a thaw in the climatic rigours is clearly implicit in the very nature of the gravel deposits, the size, compositionr manner of deposition, thickness etc. indirectly reflecting the varying dynamics of river action and valley-morphology. But the technological traits underlying both the flake accmpaniment of the advanced Acheulian and that of the incipient Middle Stone Age forms are common, if not, identical. Hence it may be surmised that it was only the differential occurrence of the raw materials, both ideal as well as intractable, in the given region that gave rise to a seeming difference in the tool culture itself. Actually speaking, in areas like Madras, Lower Deccan, Saurashtra and Kutch, the Middle Stone Age tools continue the same raw materials of Early Stone Age, namely, fine grained quartzite of different kinds. This would show that the local raw material was the preferred raw material, at least in the greater part of the Middle Stone Age.

It has been suggested by some that African parallels should not be quoted too freely for a comparison of the Middle Stone Age industries of India, but it would be worthwhile to examine as to whether the advanced Acheulian gave rise in India to the same tool evolution in the subsequent period, as happened in Africa in the Fauresmith Culture, presenting the large to medium sized bifacial point on flake as the essential tool type of the transitional phase, apart from accompanying scrapers etc. We seem to have in India also a degree of variation in tool equipment among the several regions as in Africa and it is thus a regional study that would promote a better perception of the diversification of the Middle Stone Age complex over the fairly conservative and restricted scope notable in the Early Stone Age.

The terminology of the Middle Stone Age tools in India has itself compelled certain stratigraphic assumptions. For instance, Series II used for these industries,

made the succeeding microlithic Series III and only a three-fold stratigraphic range was thus enunciated. But quite early in this century, BURKITT and CAMMIADE showed that the lower Krishna Valley, particularly, in the Kurnool-Guntur areas has essentially a four fold stratigraphy which they called by the terms Series I to IV wherein the first two of the series pertained to the Early Stone Age itself; and recent work as that of this writer and particularly of Dr. ISAAC in the Kurnool area has tended to confirm this four-fold range, originally mooted by BURKITT and CAMMIADE, and appears to be supported well by stratigraphic sequences. This definitely has been helpful in fixing up a transitional stage between the early flake techniques and the later applied flake industries. There is also a tendency to use the Middle Stone Age as a blanket covering almost the entire Indian sub-continent and in this way even the late Soan of Punjab, so typical in its limitations, has been considered by some like SANKALIA, and MOHAPATRA etc. as liable to be included directly within the Middle Stone Age complex of the rest of India. This could well be taxonomically possible, but not on direct stratigraphic correlations or cultural identity. The real difficulty would seem to be that we have no recorded evidence pertaining to the truly 'prepared-platform industries' in the major part of India, and the general trend would seem to be in favour of considering the imbibing of 'prepared-platform' techniques early in the Stone Age sequence and quick dissemination of its further developments, purely on the flake side, in the Middle Stone Age. It would appear, however, that certain sites in the Khandesh, as for instance, sites like Vadjakhan in the Amaravati Valley, and south Gujarat along the Arabian coast, sites in the Sanjan valley, would seem to give industries which are entirely flake made, which are often of large to medium sizes, and which indicate at least in their developed stages a typical 'prepared-platform' technique of core and flake forms. It would be necessary that more systematic work in these areas be undertaken.

The antecedents of the Harappa Civilization certainly did not lie in the last phase of the Stone Ages as mentioned by SANKALIA. If it is the Sukkur-Rohri tool industries which are implied by this presumption, it may be stated that notwithstanding the Sukkur-Rohri tool tradition, the Harappa Civilization would have flowered.

When we are dealing with Middle Stone Age, we had better leave out of consideration the Soan sequence, since it does not admit of any direct relationship with the collective processes which brought about the Middle Stone Age tool industries in India from those of the Early Stone Age. Neither the climatic context, nor the fulness of technical motivation is comparable to that of the Pan-Indian Middle Stone Age complex. At best, we may consider the two zones as homotaxial, in the loosest taxonamic sense, but indeed disconnected in its physical, artefactual and perhaps enthnic factors.

The site at Kapadvanj in north Gujarat is up-to-date the only Middle Stone Age site in that area. It is not known on what grounds SANKALIA thinks it should not be taken as belonging to this cultural assemblage. His only presumption is based on the fact that in the actual implement-bearing gravel terrace, a

few tools from the upper loessic deposits, yielding fluted cores of the purely microlithic facies, had been mixed. This is as inevitable as the river bed yielding tools of many descriptions. But this is easily differentiated from the main tools facies of the terrace, below the loessic loamy deposit, which had yielded a fairly consistant substantiation of the tool techniques prevalent in Middle Stone Age, in the form of medium-sized, prepared cores of many kinds, points, scrapers, flake blades etc., none of which could be considered microlithic by any chance. The fact that the bore-section near Cambay area revealed two gravels within the Pleistocene sequence, the latter of which towards the close of the Pleistocene would fit in with the Kapadvanj gravel section is a clearly reinforcing factor. Further the tools were collected from more than one site in that area, although the section and gravels were better preserved at Kapadvanj. A more thorough combing of the Sabarmati-Mahi tributary systems, than done so far, is clearly a further disideratum and should certainly yield more Middle Stone Age sites.

It has been contended that because there is the term 'Neolithic' the corresponding term 'Palaeolithic' should be retained. In the first instance, Middle Palaeolithic and Middle Stone Age have much the same significance. The real trouble will come only in respect of the Upper Palaeolithic, of the European terminology, which does not tally with Late Stone Age of India. Hence to eschew the word 'Palaeolithic' and its three-fold sub-divisions would be wise for Indian conditions.

It is clear that wood and possibly bones played a good part in the open country hunting type, as implied by the Middle Stone Age culture complex, both for purposes of hafting and for primary weapons of offence and defence in the form of bars, spiked sticks, frames for muzzling the faces of animals etc. Woodwork with simple contrivances should certainly have formed a convenient equipment for their day-to-day life. The tools on stone by themselves were primarily an adjunct or supplementing the other wood and bone implements, and the disappearance of the latter now creates a lop-sided picture of the tool kit of the Middle Stone Age man. The very diminished size of the tools of this complex would indicate that the manual pressure required to be exerted on the tool during its employment was marginal, and further that the contexts in which the tools might have been used, should have involved easily dented or tackled materials like leather etc. That the actual nature of the raw materials employed for making the tools is purely a matter of local resources and hardly any choice was left, is clearly borne out by the occurrence of Middle Stone Age tools on quartzites in areas where these alone are plentiful, in the same way as they are on silicious minerals in the Deccan, Central Indian and Saurashtra trap country or the sandstone regions. The incidence of the tools, in relation to those of the Early Stone Age would broadly seem to be identical, thereby suggesting no large decrease in the population. The casual character of the secondary retouch of many of these tools gives the impression that they are of an indefinite functional scope, but the fact of the matter seems to be that the artificers have so mastered the various tool-making techniques and so varied are their manners of employment—implying a slight refinement in the

cultural set-up of the whole community—that they have no need to make each tool beautiful-looking by complete retouch of the entire upper surface of the tool. It is this also that has resulted in the many tools which do not show a faceted platform but a single plain and sometimes even obtuse platform. This certainly does not signify that prepared platform flakes do not exist or are not much in vogue. The very evolution of the tool range has called for the short cuts in artificing and the earlier leisurely composition of the tools have not been favoured. Further, it appears quite possible that the earlier part of the Middle Stone Age gives a largish size of the tool, the emphasis being on the small sized handaxe-like point, a more methodical production of the tool, and a sure employment of the prepared platform technique as applied to flake production. But the second phase of the same Middle Stone Age has resulted in a proliferation of tool types in which the backed flake, point scraper and awl form the basic tool range, with many subvarieties in each. In these, the conscious application of the process of fabrication had largely given rise to quick slap-dash techniques.

The continued occurrence of the *Elephas* and *Bos* bones in the gravels above those of the Early Stone Age in Maharashtra would call for a more careful consideration of the actual age of the fossils and their minor adaptive variations in bone structure, if any, different for those of their mid-Pleistocene ancestors.

V. N. Misra :

The question of nomenclature of Stone Age cultures which Dr. Sankalia has briefly commented upon in his paper is a very important one and I would like to make a few observations on it. I have already set forth some of my views on this subject in a paper published two years ago which has been referred to by Dr. Sankalia in his paper. I shall briefly recapitulate these and add a few more points.

To begin with, it will be generally conceded that the question of adopting a new terminology does not arise until the unsuitability of the existing one has been satisfactorily established. This, I am afraid, has not been done so far. Dr. Şubbarao who first suggested in 1956 the adoption of South African terminology in place of the European one did not put forward any convincing reasons in support of his suggestion beyond saying that the European nomenclature did not fit in the Indian material. Later in 1961 this terminology was adopted as a provisional measure by a committee of the First International Conference on Asian Archaeology held at New Delhi with one member of the Committee, Prof. Braidwood, dissenting. It is however, known that the subject was very insufficiently discussed by the Committee and the terminology was rather hurriedly decided upon through a brief resolution. The subject requires serious discussion and cannot be finished off so easily. In Europe and Africa existing terminologies have evolved after prolonged and serious discussion and a respectable body of literature has grown around the subject. It will, therefore, not be improper to ask the champions of new terminology to explain the arguments in favour of their case. Meanwhile I shall try to show the untenability of such arguments as have been put forward, and the justifiability of the European terminology.

The argument most often advanced is that European terminology is inapplicable outside Europe because it is intended for European material only. But the fact that the terms Palaeolithic, Neolithic etc. and their sub-divisions have a chronological priority in Europe is only because of the historical accident that prehistoric studies originated and grew up in Europe. That way the terms, Stone Age, Bronze Age, and Iron Age were first coined for Denmark only and have no validity outside that country. Yet they are used all over the Old World. Further, if Palaeolithic and its divisions have no validity outside Europe, then why should these terms be used in East and North Africa, and Western, Central, and South-East Asia? Indeed it is only in South Africa that they have been discarded. The researches in prehistoric archaeology amply show that the early stages of cultural development are very similar among different societies of mankind. This fact can be emphasized only by applying a common terminology for the main cultural stages. Again, the terms Palaeolithic, Mesolithic, and Neolithic belong to one system and are complementary to each other. We have to accept or discard the system as a whole and not parts of it. Yet, the proponents of the new terminology in India discard the terms Paleolithic and Mesolithic but retain Neolithic. Finally, it may be pointed out that the term Middle Stone Age is bound to be confused for Mesolithic of which it is a synonym.

It is also said sometimes that since there is no equivalent of European Upper Palaeolithic in India, the terms Lower Palaeolithic and Middle Palaeolithic cannot be used in this country. It is rather surprising that any one should expect the cultural development in India—or for that matter, in any other region —to be an exact replica of Europe. The absence of Upper Palaeolithic in India no more invalidates the applicability of terms Lower and Middle Palaeolithic in this country than does the absence of Bronze Age in Australia invalidate the applicability of the terms Stone Age and Iron Age in that country. However, if one were to insist on this point, the difficulty can be overcome by substituting the word Late Palaeolithic for Middle Palaeolithic.

It is thus clear that the use of the terms Early, Middle and Late Stone Age in India along with Neolithic is illogical and inappropriate. The adoption of these terms in place of existing ones will only help to isolate Indian pre-history from that of the rest of the Old World and create much confusion on the subject both in India and outside.

S. P. Gupta :

Dr. Sankalia has expressed doubt about the presence of burins in the Middle Stone Age typology even though a few burins or burinates have been reported by his own students. I have not been able to see those examples and therefore cannot say anything about them. However, during my recent exploration in the Jabalpur district I have collected a few real burins from open-air factory sites of the Middle Stone Age. Technologically they are covered by the multiple facets against facets' variety of Noon's classification. Though I agree with Sri Thapar that so far the richness of variety in this type has not been found by us and with Dr. Misra

and Dr. Mate that the percentage is hardly one or two, nevertheless the examples were not accidental since the technique of producing burin-facets is highy speciali-zed and its presence does show that people knew this technique. However, it will clearly be seen by the hinge-fractures on the burin facets that either the material used (nodules of jasper in the present case) was not very congenial to such a technique or the technique itself was not perfected. Though I agree with Dr. Sankalia that my examples do not come from stratified deposits yet for two reasons I believe they can still be regarded as belonging to Middle Stone Age. Firstly, they have been found at exclusively Middle Stone Age sites so that question of their belonging to some other industry does not arise. Secondly, Sri A. K. Ghosh tells me that he has collected a genuine burin from a stratified deposit at Mayurbhanj.

I would also like to say something about the problem of burin as a functional tool.

Burin is a term applied to a chisel-edged tool used for bone and wood working. It may be used either for engraving on bone or splitting bone or soft wood. From the same sites which gave me burins I collected several examples of a tool type which has narrow edges. Technologically these tools are nearer to borer. The two sides of the flake or the nodule are retouched and slowly converge at one end to an incipient projection formed by two notches, one from each side. Now the question is as to why an edge instead of a point was the result of this technique. An examination of these tools shows two things : firstly, in almost all the cases, the flakes or the nodules were thick edged and, therefore, the retouch on the sides was steep, even vertical, and secondly, the two deep notches were intended not to produce a constricted neck of a borer but an edge on the thickness of the flake or the nodule by letting the two deep flake-scars converge with each other as it happens in the case of a typical cleaver. The end product is something like a screw-driver or extremely narrow chisel.

Now since this technology does not include the production of a burin-facet, I would not call it a burin. It is also not a ' beaked ' tool of Dr. Bridget Allchin. Let me call it a ' chisel-edged borer ' under burinate variety for the term clearly indicates the presence of a narrow edge as against a point. It is a definite type in the Middle Stone Age tool-typology in Jabalpur area.

I also show you a bifacial cordate on jaspery quartzite found along with these Middle Stone Age tools. The longitudinal flake scars on the surface are not typically Acheulian assemblage. It may be called a bifacial point made by the Acheulian technique.

The nature of the Middle Stone Age industries is certainly Indian. It has absolutely no genetical relationship with any known industries found in Africa or Western Asia or even in Indonesia. The resemblances observed are the cases of parallel developments only. Of course, some of the non-standardized types may be met with in other flake-industries of the world.

A. K. Ghosh :

Regarding the question of burins in the Middle Stone Age I may state that we have collected *in situ* burins at Bamni, near Mandla, on the Banjer, a tributary of the Narmada. Here the exposed sections reveal the topmost deposit of alluvium (7 m. to 8 m.), dull yellowish-brown in colour. It is a variety of the regur. This is underlain by a gravel bed (1·5 m.—3 m.) The recent sandy deposit merges into the present water level to from the lower bank. The gravel bed is a layered structure, formed by the process of sorting. As a result this gravel bed can be differentiated into a lower part and an upper part. In the lower part the pebbles are large, deeply patinated and consolidated, yielding flakes and blades. In the upper part, they are small, less patinated and loose. Microliths were found from this part. Out of 33 flake-blade implements there is one burin and out of 26 microliths, there is one micro-burin. The burin is on a blade of reddish chalcedony and the burin end is formed by the intersection of two burin facets at the tip.

Regarding the term " Middle Stone Age ", I would like to place before you some of my recent field data from Singhbhum. In Singhbhum the flake-blade industries are geologically conditioned. Where there is outcrop of cryptocrystalline colloidal silica, flake-blades are generally found near the vicinity. This is well established in south Singhbhum. From the archaeological sequence found in straigraphical context it is found that there are two different industries: one flake industry and other flake-blade industry. In the upper part of the section the true flake industry is found at the junction of the upper loose gravel and overlying upper brown clay. While in the case of the flake-blade industry it is found in the higher horizon of upper brown clay. As a matter of fact these two industries differ in stratigraphy, typology, technique and even raw material. Personally, I have used the above two terms (flake and flake-blade industries). I also believe that the earlier one should be included in the Middle Palaeolithic, (early Upper Pleistocene) where there is preponderance of flakes (with scrapers as dominant type) and the later one as Upper Palaeolithic (Late Upper Pleistocene) with blades and burins.

The " Middle Stone Age " is a chronological term and consists of a number of cultures. It is unthinkable that in such a large subcontinent as India with its great regional diversity there existed only one culture during the " Middle Stone Age." We may say this : that flake culture based on cryptocrystalline silica with regional variations developed during the Upper Pleistocene. It is better to describe it as a flake-blade culture-complex. There are other cultures based on non-colloidal silica and on quartzite rocks. The Upper Pleistocene was a period of cultural flux.

G. C. Mohapatra :

On the basis of the evidence at our disposal we may make the following generalizations about the Middle Stone Age.

(i) This culture may be placed within the hiatus that existed between the Early Stone Age culture and the microlithic industries. This is suggested by stratigraphic as well as typo-technological evidence.

(ii) To whatever age the upper limits of this industry may belong (probably early Holocene), its origin and early stages can now be safely assigned to the latter half of the Pleistocene on the basis of the palaeontological evidence.

(iii) From the typo-technological analysis of this industry in the Wainganga Valley, in Orissa, Madhya Pradesh, and Andhra Pradesh, it is possible to trace its origin from the last phases of the Early Stone Age.

(iv) The blades or blade-flakes and the crescentic flakes in this culture at some localities (probably the later facies) perhaps influenced such tool-types in the succeeding microlithic industries specially in their earlier stage. This typo-technological inter-relation between the developed Middle Stone Age industries and the non-geometric microlithic industries of early type can be well understood by a careful study of the microlithic industries of Giddalur II, Singrauli basin, Megananapuram Nagarjunakonda and Sanganakallu Phase I.

Due to the peculiar position of India its geography presents several contrasts from region to region as a result of which we find several regional manifestations of one basic cultural trend. One such instance can be seen in the Late Soan industry of the Punjab which is now being included within the Middle Stone Age culture complex of India.

From my lithic collection and field work in East Punjab I have gathered an impression that there are at least two types of small flake-implements which on typo-technological grounds can be placed after the Early Soan industry. The first group comes from the Sirsa valley in which we find prepared flakes, thick blades, small side-scrapers, incipient borers and bifacially flaked fine discoids. In this industry the pebble choppers are smaller and neater than those found in the Beas-Banganga valleys and the general technique is of much high standard as evidenced from well controlled flake scars, clear outline and sharp, well defined working edges. The raw material is the same quartzite used for preparing the pebble-tools in the Early Soan industry. When compared with the Late Soan industry of the Potwar region (although inadequately described by De Terra and Paterson) one finds quite a number of points on which the two industries agree with each other.

The other small flake-industry comes from the valley of the Banganga at Ror (Kangra District). The implements, about one hundred and fifty, were found from Terrace IV. It may be noted here that upper terraces i. e., Terrace I, II and III, implementiferous as regards the Early Soan pebble-tools, do not yield any such flake-implements. The chief raw material of this flake industry is a type of greyish chert. Scraper and borer are the two main tool-types which have been prepared out of flake as well as suitably thin nodules. Occasionally, one comes across a side-scraper on a flat thin pebble looking almost like a miniature pebble chopper. Majority of the flakes have been struck out of prepared cores.

Although provisionally both the industries may be included within the Indian Middle Stone Age culture complex I feel that the Industry at Ror is closer to the Nevasian and other Middle Stone Age industries of the Peninsular India than the quartzite industry of the Sirsa valley which is probably the counterpart of the Late Soan industry of the W. Punjab. Incidentally, it may be pointed out that the average size of the flake implements found at Ror is much smaller than that found from the Sirsa Valley.

It is possible that the Punjab's two contrasting geographical features, the snowy high altitude mountainous areas and the low semi-arid plains, initiated two different cultural patterns which could have been contemporaneous. Of course, a lot more has to be done before committing any thing definite but I think the so-called Late Soan industry is a developed facies of the Early Soan pebble chopper industry, whereas the difference between the Late Soan industry and that found at Ror is perhaps like the difference found between the Upper Acheulian industry with its small flake-tools and the pure flake-industry of the Levalloisian.

While observing the distribution pattern of the Indian Middle Stone Age industries one is apt to be struck by the wide extent into which this culture had spread. My colleagues in the Department of Geology, Punjab University, Chandigarh, brought me a good collection of small rhyolite and chert flake-tools from a place called Baridhani situated almost in the centre of the Indian Desert (MOHAPATRA, BHATIA, and SAHU, 1963). Thus it is very heartening for me to see Prof. SANKALIA's (1952) prediction " In fact, like the Sahara and the Fayum in Egypt, the Thar might also yield data of the Palaeolithic and Later Stone Age cultures if properly investigated ", coming true.

Recently I had an opportunity to explore the Pleistocene deposits (including the Karewas) of the Kashmir Valley. In my explorations from Baramula to Shopiyan and from Gulmarg to Pahalgam I found no implements earlier than the Neolithic found at Burzahom etc. It will perhaps be futile to search for the cultural remains of man in the Kashmir Valley older than the end of the Last Glaciation. During the time in question the whole valley including the Karewa lake was perhaps a vast stretch of ice sheet blocked from all sides by lofty snow peaked mountains. The Baramula pass through which the Jhelum flows and which is the only link connecting the Valley with the plains of Pakistan-occupied Kashmir and W. Punjab was perhaps non-existent during those days. It may be remembered here that the geologists believe that due to some tectonic features suddenly the Baramula pass was created through which the waters of the Karewa lake were drained out and thus the present course of the Jhelum was formed. This might have taken place during the late Pleistocene or early Holocene time. The Karewa lake deposits, examined by me at a number of places, show clearly stratified deposits of silt and medium sized gravels in several layers up to a thickness of three hundred feet or more.

Although a phase of small flake-implements in the Stone Age culture-sequence is now a fact beyond doubt, I take this opportunity to point out that

the difference of opinion we are having regarding a suitable terminology for this industry should not overshadow the real character of it. As it stands at pretent, this culture is not similar to the Clactonian, the Levalloisian, the Tayacian, the Aterian, the Stillbay, the proto-stillbay, the Smithfield or any other known cultures in Europe or Africa. When the Maharashtra-Karnatak Nevasian collection was shown to the late Prof. V. G. CHILDE, I still clearly remember his remarks, 'It is typically Indian–is n't it ? We should therefore appreciate this fact before looking for affinities outside India.

NOTES

1. ISAAC mentions some 40 sites. Recently Sri NAGABHUSHANA RAO has found tools on flakes in Nalgonda District.
2. A few tools, which I have seen, were collected by the Late Dr. B. SUBBARAO from terrace 3 at Attirampakkam, near Madras; PATERSON (DE TERRA and PATERSON, 1939, 327) also refers to a series of small tools from this region. I visited recently the two sites of Attirampakkam and Vadamadurai. Two terraces are clearly visible at both the sites, and typical tools such as the borer-scraper were found on the surface.
3. Here tools of various materials—flint, fine chert, and jasper—have been collected by Sri Nisar AHMED from the valleys of the Son and its tributaries which flow through the districts of Sidhi and Shahdol in Madhya Pradesh.
4. Sri Rameshwar SINGH has been working in eastern Madhya Pradesh in the valleys of the Betwa and its tributaries. He has found very interesting material. The best treatment in a short article is by R. V. JOSHI (1961).
5. Here small tools on greyish chert have been recently collected by Dr. G. C. MOHAPATRA (Punjab University, Chandigarh) from terrace 4 at Ror, Kangra District.
6. Tools on chert and jasper were found by my colleagues Dr. Z. D. ANSARI and Sri S. N. RAJGURU, and by me, from the Wagan Valley, Chitor District, in 1962. Subsequently Dr. V. N. MISRA made a larger collection.
7. Recently some tools have been reported from Kapadvanj on the river Mahi, but these do not seem to belong to this cultural assemblage (K. V. SOUNDARA RAJAN, 1960).
8. Professor A. H. Dani has kindly sent me a manuscript copy of his report which is in press, for which I am indeed grateful.
9. The tools were first reported by Dr. SESHADRI of Mysore University. Later I inspected the site with Sri M. S. NAGARAJA Rao. There is no doubt about the existence here of a typical Middle Stone Age industry; a beautiful flint-like chert is available in the local limestone.
10. DE TERRA and PATERSON (1939) distinguished between the various alluvia or river deposits on the Narmada. According to them there was an older alluvium (type I) and a new alluvium (type II). Type I was divisible into a Lower and an Upper group. The Lower was coarser (that is, more pebbly),

well cemented, and overlain by a red silty clay with lime concretions. The Upper was less coarse (that is, it was gravelly and sandy), not very well cemented, and much thicker. It was overlain by a thick bed of yellowish pink clay which was less full of lime concretions than the clay overlying the Lower alluvium. Alluvia of both types I and II contained Middle Pleistocene fauna and tools of Abbevillian, Acheulian, and pre-Soan type, but tools of the Late Soan type were said to occur in the Upper Group only. The gravel of the newer alluvium was formed principally of trap and chalcedonic nodules and "soft cross-bedded sand". In both types I and II, De Terra and Paterson noticed flakes, blades, and scrapers of jasper and other material; these they vaguely assigned to a proto-Neolithic period. The gravel was overlain by a brown silty clay. The entire deposit was said to rest against the slopes of older channels. De Terra's observations were challenged by Khatri who also made a number of remarks regarding the position of series 2 (Middle Stone Age) tools. My colleagues from the Deccan College—Dr. Z. D. Ansari, Dr. V. N. Misra and Sri S. N. Rajguru—and I have checked in the field the observations of De Terra and those of Khatri. Also, I have had an opportunity to compare these observations with observations of the Narmada stratigraphy around Maheshwar, made by the late Dr. Subbarao and myself in 1953-54 and 1957-58. In the main, De Terra's observations appear to be correct, though the various sections reproduced by him from sites between Hoshangabad and Narsinghpur are indeed reconstructions, for nowhere does one see the laterite at the base of a section or find all four deposits of the older alluvium at one place. On the other hand, at Maheshwar one finds all four deposits, as well as the latest phases of river aggradation containing loose sand. Khatri has unquestionably made extensive observations along the Narmada and elsehere, but his statements seem to be contradictory, and nowhere is a clear stratigraphical picture given.

11. S. A. Semenov (1964) has tried to infer more definite function of these tools from traces of manufacture and wear seen with the help of microscope and other devices.

13. Dr. R. V. Joshi, opines that the industry might have evolved (in part) from the Early Stone Age, as on the river Wainganga, Nagpur, where he has a better evolutionary series.

14. Joshi, in a paper presented before the 50th Indian Science Congress, in 1963, draws attention to the close similarity between the tools from the younger terrace gravels on the Zambezi, Southern Rhodesia, now exhibited in the Musee de l'Homme, Paris, and the Middle Stone Age tools from India. Professor A. H. Dani (1964) believes that the Indian Middle Stone Age culture derives from Western Asia through West Pakistan.

15. Line drawings (three views) of many of the tools are given in H. D. Sankalia, *Prehistory and Protohistory in India and Pakistan* (University of Bombay, 1962-63).

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MESOLITHIC PHASE IN THE PREHISTORY OF INDIA

V. N. MISRA

PROBLEM OF DEFINITION

It might be useful to begin this essay with a definition of the term "Mesolithic" and a consideration whether it has a validity in Indian pre-history. A perusal of the literature seems to indicate that many people in India hesitate to use the term and instead prefer the less controversial 'Microlithic'. The term 'Microlithic' is a purely technological one and has no economic and cultural connotations. However, as archaeologists, we deal with culture and so we have to divide archaeological time into cultural periods and thus the term 'Microlithic' cannot be a substitute for 'Mesolithic', just as 'polished stone axe' cannot be a substitute for 'Neolithic'. Recently Sir Mortimer WHEELER (1964, 65) has questioned the very existence of Mesolithic and Neolithic phases in India. Since for research in any discipline to make proper headway it is necessary that the concepts and terms employed in that discipline should be clearly defined, we cannot evade the problem of defining the terms 'Mesolithic', 'Neolithic' and the like. In the present context, however, I shall confine myself to 'Mesolithic' only.

Since 'Mesolithic', like most other basic archaeological terms, is borrowed from European prehistory, we can discuss its applicability in the Indian context only against the background of its meaning in European prehistoric literature. In English language, no better authoritative writings on the subject are available than those of J.G.D. CLARK and we can, therefore, take his definition of 'Mesolithick' as the standard one. As early as 1932 CLARK had written that by the term 'Mesolithic' "all that need be implied is that the particular group of cultures included in the term 'Mesolithic' occurred in point of time between the Palaeolithic and Neolithic". From his later writings (CLARK, 1936; 1962) it does not appear that he has modified this definition. However, this gives an idea only about the chronological position. From CLARK's descriptive comments, the following characteristics will seem to be the requirements of the Mesolithic cultures.

(i) They are post-Pleistocene and post-Palaeolithic.

(ii) They are characterised by a hunting and gathering economy. In this respect although Mesolithic cultures are a continuation of the Palaeolithic economy, yet the emphasis now shifts from big game to small game hunting and catching and gathering. This difference is reflected both in the ecology and technology of the Mesolithic cultures.

(iii) Their technology is distinguished by the use of microliths on a large scale.

(iv) They are mostly pre-Neolithic, but occasionally coexisted with the latter in a symbiotic relationship.

The archaeological evidence to be discussed in the following pages amply shows that communities conforming to all these critria once existed almost all over the subcontinent, but with the introduction of the Neolithic way of life in

the sub-continent from Western Asia, which began around the middle of the fourth millennium B. C. (as the available C-14 dates for Kili Ghul Mohammed would suggest), the process of their conversion to this new way of life started and indeed is still going on in the case of communities like the Kadars of Cochin, the Chenchus of Andhra Pradesh, the Juangs of Orissa, the Korwas of U. P. and M. P. and similar other people elsewheres (though all these peoples now use iron tools in place of stone and sometimes practice a bit of primitive agriculture).

BRIEF REVIEW OF RESEARCH

Since in India conditions for the preservation of tools of bone and other organic materials are not generally favourable, it is only the stone tools of the Mesolithic period (as also of earlier periods) that have survived and therefore we have to depend only on them for information regarding the technology of the Mesolithic cultures. The earliest microliths in India, it seems, were discovered by A. C. L. CARLLEYLE of the Archaeological Survey of India, in the eighties of the last century from caves and rock shelters as well as river and nullah beds in the Kaimur range in Banda and Mirzapur districts of U. P. and Rewa, Bundelkhand and Baghelkand areas of M. P. Unfortunately CARLLEYLE's work was never adequately published and the available references to it by BROWN (1889), SMITH (1906), and ALLCHIN (1958) only serve to emphasize what valuable archaeological material has been lost to us. Even the sites discovered by CARLLEYLE cannot now be indentified and located. Robert Bruce FOOTE (1914; 1916) discovered many sites in Madras, Andhra Pradesh, Karnatak and Gujarat in the last quarter of the last century though, for once, he missed the real significance of his finds and attributed them everywhere to the Neolithic which led to his well-known hiatus theory.

Little progress was made in the first two decades of the present century. Mesolithic studies were revived in the twenties when CAMMIADE (1924) published his work in the Lower Godavari area and later, with BURKITT (1930), that in Kurnool area. In 1932 TODD reported the discovery of several microlithic sites in and around Bombay and three years later HUNTER (1935-36) published the results of his excavations in the rock-shelters at Panchmarhi. A list of all the sites known till 1938 was compiled by D. H. GORDON (1938a) in that year and this was followed by a report of his own discovery of some sites in north Karnatak (GORDON, 1938b). GORDON' small note exposed the scantiness of our knowledge of the Mesolithic on the one hand and emphasized the wide distribution of Mesolithic sites and the possibilities of further fruitful research on the other. Some more material on the Mesolithic of Bombay was published by TODD in 1939.

A new impetus to Mesolithic research was given in the early forties when SANKALIA undertook a systematic exploration and excavation of microlithic sites in north Gujarat. His work continued for nearly a decade and has given us the most complete picture of the Mesolithic available for any region. (SANKALIA, 1942; 1946; 1955; 1956; SANKALIA and KARVE, 1944; 1949; SANKALIA, KARVE and KURULKAR, 1945). More information on Gujarat has been provided by the later

work of ZEUNER (1950; 1952), SUBBARAO (1952; 1958), aad KENNEDY (KARVE-CORVINUS and KENNEDY, 1964). The only other significant discovery of the forties was that of TODD (1948) at Jalahalli in Mysore. In 1950 TODD also published an integrated account of the Mesolithic of Bombay. The evidence available till that year on Indian microlithic industries as a whole was critically summarized by D. H. GORDON (1950), but since then no review of the progress has taken place.

However, it is in the post-1950 period that research in Indian prehistory has been most active and hundreds of microlithic sites have been discovered all over the country. One has only to glance through the successive issues of the *Indian Archaeology-a-Review* to have an idea of the amount of material brought to light. It will be impossible to mention all these discoveries here. Unfortunately there have been few systematic regional surveys or even intensive local studies and, what is more regrettable, very little of this new material has been published. But among the important contributions to our knowledge in this period, mention should be made of KRISHNASWAMI and SOUNDARA RAJAN's (1951) study of the material from Balia Nadi, Mirzapur; ZEUNER and ALLACHIN's (1956) study of the *teris* of Madras; LAL's (1958) work at Birbhanpur; SEN and CHATURVEDI's (1957) and RAY's (1956) work in Chhota Nagpur; the exploration by the Archaeological Survey (I. A. R. 1956-57; 1957-58; 1958-59), and this author (MISRA, 1961) in South Rajasthan; ISAAC's (1960) work in Kurnool; and VARMA's (1964) in Mirzapur.

DISTRIBUTION

The above review might have given some idea regarding the distribution of microlithic findspots in the country. By and large, it may be said that microliths occur all over the sub-continent with the exception of the Indo-Gangetic plains and Assam. In West Pakistan only a few sites are known; these include the site of Jamalgarhi cave north of Peshawar, Tharro and Jungshahi near Karachi in Sind and a few sites around Rawalpindi and Campbellpore. No sites are known from the Punjab. In Rajasthan, west of the Aravallis microliths have been found in Barmer, Pali, Jodhpur and Nagaur districts and many more sites are likely to be found in this area, particularly in the limestone region that stretches from Sojat northward for about forty miles. East of the Aravallis, there is a great concentration of sites in the Banas basin in Mewar and stray finds are recorded from Kota and Jhalawar districts further east. A few sites are known from the districts of Mandasor, Ratlam, Ujjain, Indore, Khandwa and Nimar, but the area is rich and calls for a more systematic exploration. In Gujarat and Kathiawar, particularly northern Gujarat, some eighty sites have been plotted on the map. Many sites are known from the caves and rock-shelters of the Vindhya ranges, near Hoshangabad and Pachmarhi and quite a few from northern Madhya Pradesh and south-east Uttar Pradesh in the region of the Kaimur range. Further eastward a few microlithic findspots are recorded from Chhota Nagpur and some from the valley of the Kansabati in West Bengal. Southward the Bombay-Poona-Ahmednagar region as also most of Mysore are rich in microlithic sites. The whole of the West Coast south of Bombay, is however, a blank area. The

site of Calicut is sometimes mentioned in the literature, but I have not been able to get its original reference or any details about it. Not much is known from Madras excepting the important *teri* sites in the Tinnevelly district and one or two in Madurai district. In Andhra Pradesh, Kurnool has yielded a large number of sites, but northward the territory between the Krishna and the Mahanadi is largely a *terra incognita*.

ECOLOGY

One conclusion can, however, safely be drawn from the distribution of microlithic sites. It is that the Mesolithic occupation of India was much more extensive and intensive than that of any of the two preceding Stone Age cultures. This is shown by the wide distribution and the nature of the sites occupied by Mesolithic man. Whereas Palaeolithic man had largely confined himself to river banks, Mesolithic man ventured into territories away from the river banks and hitherto unoccupied. The environments under which Mesolithic people lived may be divided into the following types.

1. Open rocky areas.
2. Sandy areas.
3. Coastal areas.
4. Caves and rock shelters.
5. River banks.

1. Majority of the sites belong to this type of environment. In south Rajasthan all microlithic findspots are on rocky elevations in the sparsely wooded country with about 60-75 cms. annual rainfall. They are sometimes several miles away from the river banks. Microlithic man here might have depended largely on small game, catching and gathering and less on fishing as there are no perennial rivers in the area. The sites in the Pali district of Western Rajasthan also belong to this type. Among others should be mentioned the sites in Karnatak, Jalahalli etc., in the copper seam belt in Chhota Nagpur, some sites in Kurnool and stray ones in many other areas. Many of these latter are situated on the lateritic soil.

2. In Europe and British Isles Mesolithic people preferred greatly sandy areas for habitation. In India also at least in two instances similar environment was preferred. These are north Gujarat and South Madras. North Gujarat is dotted with hundreds of tiny hillocks of wind blown sand. Quite often a group of these enclose a large pond affording an almost perennial water supply. The mounds are covered with scrub and along with lakes are admirably suited to support small and big game and fish and these as we know from the available bone material from Langhnaj, constituted Mesolithic man's chief source of food. On these stoneless mounds man had to import raw materials for making tools in the form of pebbles, probably from the river beds. Almost all these mounds sheltered small hunting communities as is testified by the presence of microliths and their waste products and animal bones on their surface.

Another sandy region is the *teri* sites in the Tinnevelly district of Madras. Here also microlithic people lived on the sand dunes. They were close both to sea and river.

3. The only truly coastal sites are those near Bombay. Most of them are located in the northern part of the Salsette island, on low hillocks or rocky ground. Along the centre of the island runs a jungle-covered ridge of basalt sloping gradually to the west and steeply to the east. Agate-bearing seams occur in the intra-trappean dykes and these formed the source of raw material for the microlithic industry. Shores of the island are indented with tidal creeks and mangrove swamps. Plantain and coconut are available on the coastal plain and fish and fowl abound in and close to the creeks. Microlithic man certainly had a very attractive environment here, an environment which was broadly similar to that of the Maglemoseans of the north-west Europe. Catching and fishing must have played an important role in their economy as did hunting.

No strictly coastal sites are known along the East Coast. But the *teri* sites of Madras can perhaps be included in this group. Although at present these sites are five to ten miles from the sea, they probably stood closer to it in prehistoric times.

4. Many caves and rock-shelters occur in the sandstone region of the Vindhya and Kaimur ranges in Madhya Pradesh and southern Uttar Pradesh. They are generally situated in thickly wooded country. Many of them were occupied by Mesolithic folk. Among the better known of these are the caves and rock-shelters near Pachmarhi, rock-shelters near Hoshangabad, and Morhana Pahar and Lekhahia etc. in Mirzapur. Mesolithic people occupying these caves and rock shelters had a plentiful supply of big and small game as well as wild fruits and roots. That hunting played a more important part in their economy than in that of other communities is reflected in their technology as well as art. Microliths of the geometric type which would have served the function of arrowheads are more common at these sites than elsewhere and hunting scenes are depicted in paintings on the walls of caves and rock-shelters which they occupied.

There are two well-known groups of caves in the Kurnool district of Andhra Pradesh, but as yet little is known about their occupation in prehistoric times.

5. While some Mesolithic communities exploited new environments, others continued to live along the river banks in the manner of their Palaeolithic predecessors. A large number of sites of this period are found in close association with rivers. The sites on the Balia Madi in Singrauli basin, Birbhanpur in West Bengal, those on the river Sanjay in Bihar, along the Nahi and Sabarmati in Gujarat, may be mentioned among the better-known ones. Though near the river, the sites are on laterite plains, which were once heavily wooded. In fact this type of sites occur in every area.

TECHNOLOGY

As already stated earlier, the only artefacts of the Mesolithic period which have survived the ravages of time are microliths. Though certain forms are

common to all the areas, there are others which are either restricted to certain cultures or industries only or are more numerous in some industries than in others. The tool types common to all the industries are the blunted-back and obliquely retouched blades, simple points-both symmetric and asymmetric-made mostly on flakes, various types of scrapers, borers and to some extent burins. Among the geometric types triangle and trapeze occur in Gujarat, Bombay, Banda, Mirzapur and Rewa, Central Indian sites of Jabalpur, Pachmarhi and Rajpipla, Mysore and Kurnool. Triangle alone occurs in the Lower Godavari and *teri*. But the most common is the lunate which occurs in nearly all the areas except in Rajasthan where it is known only from three or four sites. However, not all the lunates described and illustrated are truly geometric. For instance, many of the specimens from Giddalur (SOUNDARA RAJAN, 1952) and Birbhanpur are only approximations to geometric shape, and specimens that are made to geometric precision rarely occur in large numbers. On the whole geometric forms are poorly developed both in quality and numbers except at the central Indian cave and rock-shelter sites. Here in the caves and rock-shelters in the Mirzapur-Banda-Rewa area CARLLEYLE found them literally in thousands (SMITH, 187) and his observation is fully corroborated by the results of the excavation recently conducted by VARMA (1964) in a shelter in Mirzapur. Southward at Pachmarhi in Mahadeo hills and at Jabalpur GORDON (1950, 69) says they are plentiful and from his illustrations they certainly appear to be well-finished. Though simple points both on blades and flakes are common, bifacial and tanged varieties are extremely scarce. The former are known only from *teris*, south Rajasthan and one or two specimens illustrated from Kurnool may approximate to this type. Of the tanged points one single-shouldered specimen is illustrated by SESHADRI (1956, pl. XV, fig. 14) from a site near Bangalore and some specimens from Kurnool are illustrated by ISAAC and SOUNDARA RAJAN and a few double-shouldered examples are known from Rajasthan. No other genuine examples are known. Burins occur in Gujarat, Bombay, Mysore, Kurnool, Orissa and Birbhanpur. Micro-burins are extremely rate; one specimen is known from *teri* sites and three or four from Bombay. Another uncommon type is *petit tranchet* or transverse arrow-head. The examples known come from Jalahalli and the *teri* sites.

The distribution of various types in different regions is shown in Table I.

Table I

DISTRIBUTION OF MICROLITHIC TOOL TYPES AND RAW MATERIAL

	Backed blade	Obliquely blunted blade	Asymmetric point	Symmetric point	Bifacial points	Tanged point	Triangle	Trapeze	Lunate	Burin	Microburin	Transverse arrowhead	Scraper	Borer	Raw material
Rajasthan	X	X		X	X	X							X	X	G, J, Q,Q,T, F,CY, N
Gujarat	X	X	X	X			X	X	X	X		X	X	X	C, CY, A, Q, QT
Singrauli Basin	X		X						X						Q
South Mirzapur Rewa & Bundelkhand		X		X			X	X	X						C, CY, J, A
Bihar	X	X	X	X					X				X		C, F
Orissa	X			X					X	X			X		QT, C, O
Birbhanpur	X		X	X			X						X	X	Q, C, CY, QT, W
Central India	X	X	X	X			X	X	X				X	X	C, CY, J, Q,
Bombay Area		X	X	X			X	X	X	X	X	X	X	X	C, CY, A, S
Mysore		X	X	X		X	X	X	X			X	X	X	J, R, CN, A, F, O, Q
Kurnool		X	X	X	X	X	X	X	X	X	X	X	X	X	C, J, SE, Q, QT, S
Lower Godavari	X	X		X			X		X			X	X		C, J, ST, Q, QT, S
Madras	X	X	X	X	X		X		X		X	X	X		C, Q, W.

Abbreviations :—C-Chert; CY—chalcedony; J-jasper; A-agate; F-flint; W-silicified wood; Q-quartz; QT-quartzite, R-rock crystal; S-Indurated shale; ST-slate. CN- Carnelian; O-opal.

Microliths were mostly made on blades which were detached from fluted cores. These are of the flat-based, conical, and chisel-ended varieties and have been worked from one, two or even three directions. An intereting piece of evidence regarding the manufacture of microliths is provided by the finding of a rhinoceros shoulder blade at Langhnaj. This shoulder bone of which the spine seems to have been deliberately detached bears eight pits on its lower, and one on the upper, surface. By experimenting on a horse shoulder blade ZEUNER (1952) came to the conclusion that the bone was used as an anvil for manufacturing microliths and the pits on the upper face were caused by the repeated strokes given to detach the blades from cores and the one on the lower face by chipping or retouch. The size of the tools varies from less than 2 cms. to 5 cms. depending on the size of the nodules available for work.

Besides microliths, the only other stone tools of the period known are a few choppers and ringstones. Some wedge-shaped choppers and axes were found by TODD at Yerangal Point, Bombay and a few discoids, choppers and hammerstones come from the *teris*. One complete and two fragmentary specimens of ringstones with hour-glass perforation are known from Yerangal Point and one ringstone was found in the excavations at Langhanj. However, with the exception of Langhanj ringstone all other objects are from surface and their exact association with microliths is unproven.

Tools of bone have very rarely survived. At Langhnaj among the animal bones there were many pieces which were cut obliquely or at right angles to the long axis. These have been described as artefacts but no definite shapes are known. A 13-inch long harpoon-like bone with four teeth on one side and one on the other is also known from the same site. A bone awl is illustrated by GORDON (1950; fig. 3, 10) from Jabalpur. It is almost certain that bone harpoons were used by Mesolithic folk. They are shown in the hunting scenes depicted in the cave paintings in Mirzapur (COCKBURN, 1883, pl. VII; 1889, fig. 3) and copper harpoons of the Ganga basin can only be satisfactorily explained as metal imitations of the bone proto-types.

OTHER KINDS OF EVIDENCE

Evidence other than that of tools is very scarce from Mesolithic sites, firstly because stratified sites are rare and secondly even at these sites hardly anything beyond the imperishable stone has survived. The only significant exception is the Mesolithic sites of Gujarat where, particularly at Langhnaj, animal and human bones have been preserved in good quantity though not always in good condition. Recent study of the bones from Langhnaj by CLUTTON-BROCK (n. d.) shows that ten species of mammals are present at the site. These include Indian wolf, Indian grey mongoose, one-horned rhinoceros, Indian wild boar, spotted deer, hog deer, barasingha or swamp deer, black-buck, nilgai, and bovines. However, because of the limited and fragmentary nature of the bovine bones no certain identification of species could be made nor is it clear whether they belong to wild

or domesticated species. CLUTTON-BROCK says that " except for the mongoose skeleton and possibly the remains of *Canis cf. lupus pallipes* the bones and teeth are all the remains of animals killed for food. The charring of the bones suggests that cooking was done over an open fire and in fact this is the only type of cooking possible for people who had no pottery ". Besides, there are also bones of rodents like rat and squirrel, and of fish and tortoise.

Langhnaj has also yielded more than a dozen human skeletons and they give us some idea of the mode of burial as well as the anatomical features of the people. The dead seem to have been buried within the habitation area. The skeletons are found lying in a tightly flexed position and the orientation of the body is either in a west-east or east-west direction. In several cases vertebral and rib bones are missing suggesting a secondary burial. The bones are partly mineralised and in a fragile condition. According to Dr. EHRHARDT, (n. d.) who has made a detailed study of the skeletons, old signs of blows, break, and splits in the skulls show that the people were slain and the blows were delivered by some blunt weapon. Racially, they display Mediterranid and Veddid features not in a pure but considerably mixed state.

CARLLEYLE reports that he found human skeletons in grave mounds in the general area of the caves and rock-shelters in Mirzapur-Rewa-Bundelkhand region in association with the same type of implements which he found in the caves and rock-shelters. The skeletons were in a fragile condition and could not be lifted (SMITH, 1906, 187).

While excavating the habitation deposits in the caves and rock-shelters, CARLLEYLE came across pieces of haematite showing surfaces that had been rubbed to produce pigment, in close association with microliths. These had also been found in Gujarat. CARLLEYLE further found undisturbed layers of embers and charcoal showing unmistakably that the caves had been occupied by the same people who manufactured the microliths found in them. On the walls of the caves and rock-shelters, he found paintings depicting scenes in the life of stone-chippers as also animals or animal hunts by men equipped with bows and arrows, spears and hatchets (SMITH, 1906, 187).

MICROLITHS AND POTTERY

The question of the use of pottery by Mesolithic people was critically discussed by GORDON (1950) and he made out a case for the presence of pottery with microliths at Langhnaj, Marve (near Bombay), Morhana Pahar caves in Mirzapur, some sites in Kashmir and some in Lower Godavari. At Langhnaj though pottery certainly occurs in the upper levels, its presence in the true Mesolithic layer, according to SANKALIA (1956, 276) is not so clear. SUBBARAO (1958, 73-74) in his subsequent and limited excavations at this site found a few highly comminuted sherds of pottery. The size and number of the sherds are too small to provide any idea of the nature of the fabric and shape of the vessels. Some sherds have also been found during the last year's excavation by Dr. KENNEDY

but here again, there is hardly any sherd more than two inches long. They have a dirty grey appearance and a dull greenish core and are extremely ill-fired. It is not unlikely that the sherds in the lower levels have been introduced through infiltration in the sandy soil from top levels. It needs a bigger excavation to solve the problem beyond doubt and till that takes place we shall be better advised to regard the Mesolithic culture of Langhnaj as devoid of pottery.

At Pachmarhi the extent of GORDON's (1950, 74), excavation was, by his own admission, too small to yield any conclusive evidence. HUNTER's excavation at Pachmarhi also yielded little or no pottery in the lower levels (GORDON, 1950, 75). At Marve the total deposit was only six inches and it is quite likely that the few sherds found may be recent admixtures (Todd, 1939, 275). Kashmir sites of Sombur, Pampur and Burzahom were believed by DE TERRA to be of a Neolithic or early historic date (DE TERRA and PATERSON, 1939). Recent excavations at Burzahom have clearly proved it to be a Neolithic site (GHOSH, 1961, 11). Besides, we know little about the microlithic industry of Pampur. In Morhana Pahar CARLLEYLE is said to have found " rude pottery roughly and simply ornamented by strokes." (BROWN, 1889) Recently, excavation by R. K. VARMA of a rock-shelter and an open-air site in Mirzapur has yielded small sherds of hand-made, ill-fired pottery in association with geometric microliths. This phase, according to VARMA, is preceded first by a geometric industry and later by a non-geometric industry, both unassociated with pottery. In the Lower Godavari CAMMIADE (1924) found microliths with funerary urns and " in suspicious proximity to urns of a protohistoric period ". From this it would appear more likely that these microliths belong to a late culture, perhaps Chalcolithic than to the Mesolithic. Finally, it must be stated that no evidence of pottery has been found in the excavation at Birbhanpur, at the *teri* sites, in the Singrauli basin or at any of the numerous sites from which microliths have been reported in recent years.

The position regarding pottery may, therefore, be summed up as follows : at a majority of the sites, and particularly those indicating greater antiquity such as the *teris*, and Birbhanpur, pottery is certainly absent. At several other sites where its association with microliths has been reported, it is not clear whether the sites are truly Mesolithic or of a later age. The only area where it is unmistakably associated with microliths is the Kaimur region of Mirzapur. But since this region is a geographical and cultural *cul-de-sac* it is not unlikely that the Mesolithic occupation of the area is comparatively late and the presence of pottery due to contact with pottery-knowing peoples in the neighbouring plains.

MICROLITHS, COPPER, AND POLISHED STONE AXES

The microliths that we have been considering so far belong to the hunting and food-gathering communities. But the use of stone tools of the microlithic size and (to a limited extent) type was common even among the food-producing communities. Stone remained the principal material for tools among peasant and urban societies even after the use of copper and bronze had become

known, for these metals were in short supply and therefore only richer and influential sections of the society could afford them. It is only after the discovery of iron that metal tools became sufficiently common to replace tools of stone. Thus we find that in India among the Bronze Age cities of the Harappa Civilization as well the Neolithic (agricultural-pastoral) village communities of Central India and the Deccan blade tools of stone were used in large numbers along with copper axes and/or polished stone axes. However, in these communities true microliths such as retouched blades, triangles, trapezes, lunates, points and burins are very rare and the common tool is a parallel-sided thin flake which is only occasionally retouched. This flake served as an all-purpose utility knife-blade for the household as well as outdoor requirements. This marked difference in tool-typology of the hunting food-gathering communities on the one hand and urban and village communities on the other is no doubt due to different economic requirements. Microliths served the function of arrow-heads and barbs in arrows and harpoons and were therefore useful to Mesolithic hunters. But they lost their utility to urban and village communities which had largely liberated their economies from hunting and food-gathering. In fact, the disappearance of microliths from village and urban communities seems to be in direct proportion to the degree of urbanisation (or liberation of economy from hunting and food-gathering) attained by them. For instance, in a collection of 1408 blades from Mohenjodaro, GORDON (1950, 77) found only 58 which showed ' any form of working ' and probably none sufficiently retouched to be described as microliths. At Navdatoli, on the other hand, there were 254 retouched tools in a collection of 2579 blades (SANKALIA, SUBBARAO and DEO, 1958) and the corresponding Figures for Nevasa (SANKALIA, DEO, ANSARI and ERHARDT, 1960) and Tekkalkota (unpublished, information from Dr. H. D. SANKALIA) are 807 and 188;and 2939 and 981, respectively. The disappearance of the true microliths in urban and village communities is thus due to a secondary simplification caused by the requirements of the new economy.

One more respect in which the blade tools of the Chalcolithic-Neolithic cultures differ from the microliths of the Mesolithic cultures is the technique of manufacture. It is called the crested-guiding-ridge technique and is common to all the Neolithic societies. At the same time, it was unknown to Mesolithic communities. The earliest recorded appearance of this technique is said to be in the Neolithic levels of Jericho whence it was diffused to both west and east. The technique and its history have been described in detail by SUBBARAO (1955) and, therefore, need not be gone into here.

DATING

No microlithic industry has so far been dated by C-14 or any other method which can give us an absolute dating. Perhaps the one exception is *teri* industry for which an absolute dating has been suggested on the basis of eustatic changes of the sea level. Thus we have to attempt only a relative dating for the microlithic industries. For this, the available evidence may be considered under three heads :—

1. Stratigraphical.
2. Eustatic.
3. Cultural.

1. STRATIGRAPHICAL

In most of the areas in India, microliths occur on the surface; the only places where they have been found in a stratified content are Gujarat, Birbhanpur, Sanganakallu and Jalahalli in Mysore, the Jabalpur-Hoshangabad and the Mirzapur-Rewa-Bundelkhand regions in northern Madhya Pradesh and Southeast Uttar Pradesh and Kuchai in Orissa.

At Langhnaj the microlithic deposit is generally 1 m. to 2 m. and is divided into 3 cultural layers. The top level about 1 m. thick yields microliths, modern looking pottery and a few iron as well as copper objects. The second layer 1 m. to 1·3 m. from the surface has given microliths, bone splinters and small sherds of coarse, ill-fired pottery and also a broken celt-like object and a stone-ring. The final layer has produced plentiful microliths, animal bones, and human skeletons but little or no pottery. The Mesolithic culture does not show any evidence of contact with either the Harappa culture or other proto-historic cultures that flourished in Gujarat and should, therefore, be earlier than them.

Other evidence also favours a fairly high dating for this culture. The fauna which is quite varied does not show any evidence of domestication. This again would hardly be possible if communities familiar with the art of domestication existed in the area. Particularly significant is the presence of rhinoceros which not only suggests a wet climate and more wooded environment (though ZEUNER (1963) now thinks that this animal could have lived in the wooded nullahs along the river banks even though mounds were not well-wooded) as it is now known to have existed in the area in historical times. Further, ZEUNER (1950) found that the Mesolithic culture is associated with a buried soil which suggests a wet climate and an interruption in the wind activity that had prevailed in the area since late Pleistocene times. It has been suggested that climate in this part of India changed to better conditions at the close of the Last Glaciation and this buried soil phase may, therefore, belong to that period. (DE KOSTA in Rydh, 1959, 19).

At Rangpur microlithic industry occurs in a gravel lens below the Harappan deposit. Although, judging from the published illustrations, the number of true microliths is very small and most of the artefacts are amorphous flakes and blades, the limited evidence shows that this microlithic industry is pre-Harappan which in absolute years means pre-2000 B. C. (RAO, 1964).

The microlithic deposit at Birbhanpur lies over a layer of mottled, silty sand mixed with lateritic pellets formed partly by the decomposition of sandstone bed-rock and is sealed by one or more layers of sandy earth mixed with lateritic pellets. A chemical and mechanical analysis and microscopic examination of some 30 soil samples from different layers by Dr. B. B. LAL show that pre-microlithic layers were laid down under conditions of heavy rainfall of the pluvia

type. This climatic phase may, therefore, have corresponded with the last pluvial period. Since there is no intervening deposit between the lateritic and the microlithic layers, it is likely that the microlithic culture may belong to the early HOLOCENE (LAL, 1958, 39-48).

At Sanganakallu in Bellary, SUBBARAO found a large number of trap flakes and quartz flakes and blades in a stratum which underlay the Neolithic deposit but was separated from the latter by a sterile layer. Because of the intractable nature of the raw mateiral, no definite shapes can be discerned in the quartz flakes and blades. If the industry is, however, really a microlithic one, then it is clearly pre-Neolithic and on the basis of Utnur dating of the Neolithic culture could be earlier than 2000 B. C. At Kuchai in Orissa also microliths occur below the Neolithic levels (information from Dr. SANKALIA).

The microlithic deposit at Jalahalli hear Bangalore occurs over a lateritic formation on a granite rock. The microlithic layer is sealed by a layer of black soil the top one foot or so of which yields iron age pottery, but the lower part is sterile. Thus the evidence only shows that the microlithic industry is pre-Iron Age.

At Pachmarhi in the Mahadeo hills Dr. HUNTER dug a rock-shelter and found microliths, bone pieces and (in the upper levels only) pottery. Since the microlithic layer is neither preceded nor followed by any other deposit, the evidence has no dating value (GORDON, 1950). Similar is the case with Adamgarh where Dr. JOSHI found microliths in the black soil but the overlying strata did not yield anything (I. A. R. 1960-1961, 13).

In his excavation of caves in and around the Kaimur range, CARLLEYLE found microliths in the upper portion of the deposit and more archaic tools in the lower parts. We do not know what the so-called archaic tools exactly were, but they are likely to belong to a late stage of the Palaeolithic. Thus Mesolithic culture here would appear to be a continuation of the Palaeolithic (SMITH, 1906). On the Balia Nadi at the border of U. P. and M. P. microliths occur below 4 feet of alluviam. What time this deposit actually took to form can hardly be guessed and thus no idea about the antiquity of the industry can be formed (KRISHNASWAMI and SOUNDARA RAJAN, 1951, 59).

EUSTATIC

The only example where an attempt has been made to link the ancient tool-bearing deposits with sea level changes is the *teri* sites. Here microliths occur on the surface of windblown sand dunes or, where the A horizon of the dunes has been blown away, on the lateritic hard pan. After the formation of the dunes weathering took place and this stained the artifacts red. This period was followed by a resumption of wind activity. The weathering phase corresponds to a drop in sea level from 20 ft. to 0, or even to a negative isolation and the prehistoric sites would belong to a period when the sea level stood about 20 to 30 feet higher than to-day. On the basis of this eustatic change in the sea level and its relation to *teri* sites ZEUNER dates the microlithic sites to about 4000 B. C.

with the " proviso that further geological research may push them back into the Pleistocene. " ZEUNER himself remarks that in view of the scarcity of datable microlithic sites not only in India but elsewhere as well, the *teri* sites must be regarded as important (ZEUNER and ALLCHIN, 7–8).

CULTURAL

In South Rajasthan some 50 microlithic sites have been located in the Banas basin: many of them are in close proximity to the village settlements of the Ahar Culture. Fairly extensive excavations at Ahar have not revealed any evidence of the use of blade tools there (SANKALIA, 1962) nor have my surface explorations at several kindred sites in the same area yielded any microlithic tools. Further, there is no evidence at all of the use of crested-guiding-ridge technique at any of the microlithic sites. Thus the microliths from these sites can only be explained as belonging to Mesolithic hunter-food gatherers who occupied the area before the establishment of early peasant settlements there.

For the remaining numerous microlithic sites in the country there is no evidence of any kind to date them. All that we may say is that since they are free from crested-guiding-ridge technique, they are either pre-Chalcolithic or contemporary with Chalcolithic cultures but without coming into contact with them.

This rather lengthy consideration of the dating evidence will show that at least in some areas, for instance, Gujarat, South Madras, and West Bengal, microlithic industires indicate a fairly high antiquity, perhaps going back right upto the beginning of the Holocene. On the other hand in isloated areas, particularly the caves and rock-shelters in the jungle-clad country of Central India the use of microliths might have survived into well-nigh historical times. In fact even after the use of stone tools became obsolete several peoples continued to lead the Mesolithic mode of life and are indeed have been doing so to our own days.

COMMENTS

H. D. Sankalia :

There is no positive stratigraphic evidence about the Mesolithic stage of culture in India in the sense that it is available in Europe and Africa. But there is little doubt that we have got a cultural stage when man was emerging from the Old Stone Age period but was still a hunter-fisher and food-gatherer and carried out all his activities with small tools of stone.

Secondly I would like to draw your attention to the existence of dentalium shells which have been found in the excavations at Langhnaj. Unfortunately we have no absolute date for this microlithic site in India. Therefore it is impossible to relate it with any sites outside India. However, the fact has got to be remembered that dentalium shells have been reported from Mount Carmel and from Khirokitia in Cyprus and everywhere these have been dated to a period before 5,000 B.C. In fact MELLAART (1962) has even suggested that dentalium shells may be regarded

as a type fossil of a period between 5,000 and 7,000 B. C. Whether Langhnaj is so old as that or not, one thing is certain that these shells indicate contact of the Langhnaj people with the Arabian Sea, which is at least 60 to 100 miles to the west or south-west of this site.

Regarding pottery only small pieces have so far turned up, but its occurrence or non-occurrence does not in any way affect the character of the culture.

A fresh excavation has been carried out at Langhnaj and bones from the most recent upto the earliest levels have once again been collected and now these are being examined by Dr. OAKLEY of the British Museum. We can, therefore, expect to get an absolute dating for the various levels at Langhnaj based on nitrogen, fluorine and uranium content of the bones.

B. K. Thapar

Mesolithic of India does not seem to be similar to that of Europe and as such it would be inappropriate to classify certain industries under 'Mesolithic' following the pattern of Europe where its usage is restricted to those archaeological materials which indicate various cultural readaptations to the early post-glacial succession of environments. In some areas, notably North-western Europe, it is difficult to determine whether Mesolithic-ness is different from Upper Palaeolithicness. Not surprisingly, our understanding of end-glacial and early post-glacial times in the subcontinent on the other hand is very insecure and fragmentary, and compared with Europe much less is known of the new subsistence patterns which emerged at the end of the Pleistocene. In the scale of evolution we cannot trace, in adequate detail, the step-by-step transition to food production. It is, therefore, difficult to determine the technological or economic stage presented to us by the microlithic industries in India. Communities conforming to the criteria outlined by Dr. MISRA existed all over the subcontinent. All microliths cannot, therefore, be of the Mesolithic affiliation in that sense. A blanket term Late Stone Age was recommended by the International Committee for such industries.

It is, however, certain that by the end of the glacial times the hunter-collectors had become more specialized in food collection and were better equipped with varied and ingenous tools. This specialized food collection stage has not been identified in India. Recently, however, much welcome data has been furnished by the excavations at Gudiyam in District Chingleput (Madras) and explorations along the Subarnarekha in District Singhbhum (Bihar), where an evolution from a post—Acheulian industry to the microlithic is discernible.

Under Environments, one could notice that open rocky and sandy areas are ideally suited as natural habital zones for domesticates may have evolved a relationship under hot, arid conditions. We must, therefore, look to the microlithic industires of these regions for any possible clue for the transition.

About Dr. MISRA's reference to paintings in the caves and rock shelters, I should be sceptical about their authorship going to the so-called Mesolithic people.

Lastly, I would like to emphasize that the vital need at the present stage is to investigate whether there was any continuum or diffusional stimulus of microlithic tradition from the aceramic non-geometric through geometric series into the Chalcolithic or Neolithic cultures. The blade industry associated with the Neolithic phase in the Peninisula and the Chalcolithic phase in Northern Deccan and Central India also contains microlithic components represented by such ubiquitous types as point, lunate, trapeze, etc. Wherefrom were these types, of which the function was perhaps different from that of blades, inspired? A question is posed as to what happened to the *teri* industries in the South and Langhnaj industries in Western India?

K. V. Soundara Rajan :

Dr. MISRA favours what is a rather obsolete terminology for the concluding phases of the Stone Age in India instead of a progressive and adequate terminology, as has been suggested in recent times, and particularly agreed upon as the most feasible, during the Seminar on Archaeology at the time of the Centenary of the Archaeological Survey of India. There seems to be no real need for a reintroduction of the outmoded terminology. Decades back when the cultures of the truly Palaeolithic and the truly Neolithic in Europe had resulted in a lack of understanding of the exact context of a number of industries, called then kitchen-*midden* industries, starting with Azilian, Tardenoisian, Maglemosian, Campignian and ending with the Gravettean, these were bundled under the ominbus term "Mesolithic", mainly in the sense of being intermediate without being technologically genetic with the succeeding Neolithic. In India the Late Stone Age industries are also completely microlithic having mainly two stages typologically, namely, non-geometric and the geometric and they live in atavism in many pockets, until the crested ridge technique rejuvenates them just enough to live for another day before they completely die out and give rise to the use of metal. Dr. MISRA has stated that the technology of these tools is distinguished by the use of microliths on a large scale. This is a truism as they are composite tools and a demand-supply ratio is there. With reference to Ecology, Dr. MISRA has enumerated five types of environments under which Mesolithic people lived. From the varieties of these environments it is obvious that there was no preferred habitat for the microlith using men, and in each of their physiographic zones they found themselves at home. It is needless to state, however, that no microlithic sites would have been found inside thick forests. A reference to a scarce rain fall in certain areas of south Rajasthan where microlithis have been found, has been made. We may note that in Tinnevelly, Gujarat and Rajasthan (Marwar) there is a sand dune-oasis ecology, and climatic condition between the Late Stone Age and today do not seem to have changed drastically. The fact that rhinoceros was extant at Langhnaj in Gujarat itself shows further the nature of the climate. Langhnaj may indeed be similar to Burzahom of Kashmir on the transitional stage to regular farming from hunting-gathering economy using crude pottery. The age of Langhnaj might not be earlier than c. 1500 B. C.

In the Table attached with Dr. MISRA's paper among the tool types found in India microburins are also mentioned, as found in Bombay, Kurnool and Mysore, but we have yet to know whether, on the one hand, microburin is a real tool type and, on the other, if it is a residuary of the fabrication of trapezes, as had indeed been true of certain sites in Europe. The occurrence of a few ring-stones and choppers at Langhnaj along with microliths would indeed not show any purely microlithic economic trait, but a trend suggestive of a developing food gathering economy. Indeed Langhnaj culture by and large could now be considered a transitional stage between Late Stone Age and the proto-historic age of food cultivation, particularly since the presence of mammals like cow or ox, goat or sheep, pig, Indian buffalo, dog etc., apart from the black-buck, stag and rhinoceros, would show the range of animals seemingly in various stages of domestication that enriched the Langhnaj site.

It would be difficult to agree with Dr. MISRA when he states that till a bigger exacation of Langhnaj takes place, we shall be better advised to regard to culture of Langhnaj as devoid of pottery. It should indeed be the other way round and from all the evidences one can now establish the positive presence of pottery, though yet not in identifiable forms, and this has a considerable impact upon the evolution of the whole culture.

Referring to HUNTER's exacavations at Pachmarhi Dr. MISRA has stated that it has yielded little or no pottery in the lower levels, but what he has failed to mention is that it did yield pottery, as recorded by HUNTER himself, on the slightly upper levels, and recent excavations in the Vindhyan region at Morhana Pahar, Baghai Khor etc., by the Allahabad University, on the one hand and Modi in the Chambal Dam region of Madhya Pradesh by WAKANKAR, on the other, clearly show that in almost all these sites, as in Central India, the evolution is from a non-geometric non-pottery level at the very lowest to a pottery using geometric microlithic level from the immediately next stage onwards.

Dr. MISRA says under 'Dating' that microlithic culture does not show any evidence of contact with either the Harappan culture or other proto-historic cultures that flourished in Gujarat and should be earlier than them. It may be noted that the Late Stone Age culture could not have had any direct relationship with the semi-urban tendencies that sprouted in many spots in Sindh-Punjab as well as in Gujarat during the Harappan times and this therefore does not have any impact with their mutual chronological sequences. Indeed the microlithic industries continued in many places even much later to the Harappan and had their own typological and ecological features.

R. K. Varma :

I have recently excavated two microlithic sites, namely Morahana Pahar and Baghai Khor shelter no. 1 near the village Bhainsaur on the Great Deccan Road in Mirzapur district. The excavations have revealed a sequence of microlithic industries starting from non-geometric pre-pottery stage to geometric types associated with pottery.

The open-air habitation site on the Morhana Pahar yielded a maximum deposit of 90 centimeters. It revealed six deposits. The earliest layer 5A, was formed by a highly decomposed coarsegrained sandstone with horizontal bedding. It yielded no evidence of human habitation. Layer 5 was composed of rolled kankars, gravels, big rolled sandstone pebbles and sand. The microliths in this layer are non-geometric and are unassociated with pottery. The composition of the succeeding layers 4 and 3 is similar to that of layer 5 with the difference that the rolled kankars and gravelly pieces become diminutive. The microliths of layers 4 and 3 are associated with pottery and are geometric in character. The pottery is ochrish red with greyish section and rolled edges. Layer 2 and 1 are composed of wind-borne fine sandy materials. The microliths of these two layers are very diminutive. The associated pottery is similar to that of the preceding layer. The top of layer 1 yielded an iron arrowhead of rectangular section.

The rock-shelter No. 4 in the same locality was also excavated. In a deposit of 55 centimeters four distinct layers were marked. The microliths in all layers included both non-geometric and geometric types and were associated with the same type of fragile pottery as found in the open-air habitation site. The tools of layers 1 and 2 of this shelter are also markedly diminutive. Here, too, from the top of layer 1 an iron arrow-head of rectangular section was discovered.

The Baghai Khor rock-shelter had a deposit of 55 centimeters comprising four distinct layers. Layer 4 yielded non-geometric microliths but no pottery. The tool types comprise blunted-back-blades, lunates, awls, and burinate tools. Layer 3 yielded besides non-geometric microliths, a few small sherds which can be divided into three groups. The first group consists of hand-made pottery of coarse greyish section. It is ill-fired and ochre-washed. The second group of pottery has a thin section and ochrish red slip. The third group also has thin section but it is better fired and well-made. It has a reddish slip. Layer 2 yielded microliths of both non-geometric and geometric types associated with pottery similar to that found in layer 3.

An extended human burial in articulated condition was found buried under layer 2. The burial pit was cut into layers 3 and 4. The bed-rock over which the skeleton lay directly was dressed in order to provide a raised platform for head and feet and a comparative depression for the body. Due to later pits, part of the skull and face was damaged. The orientation was west-east. The whole skeleton was found covered with thin stone chips.

Sri R. N. Gupta of the Archaeological Survey who is studying the skeleton tells me that it belongs to a young female of 20 to 21 years age. The calculated stature is 152.68 cm. The lower limbs as compared to the upper ones are comparatively stout and strong with well developed areas of muscular attachments. This indicated that the lower limbs were in greater use than the upper ones which also befits with natural hilly environments in which its owner lived.

Layer I was compact and regular and of darkish colour. Besides microliths and pottery of the usual type, it yielded a few sherds of a black pottery and two iron arrow-heads and a piece of iron. The iron objects were found while scraping the surface of layer 1 and they do not form part of the microlithic assemblage.

The above evidence shows that the microlithic industry of Mirzapur developed through four stages. The earliest stage is represented by non-geometric crude tools made mainly of cherty material. These are unassociated with pottery.

In the second stage geometric shapes appear but they form only a small percentage. These two are unassociated with any kind of pottery.

In the third stage hand-made pottery makes its apperance. This would mean that geometric microliths precede the emergence of pottery.

The microliths of the fourth stage are similar to those of stage three with the difference that now they become extremely diminutive. The percentage of geometric shapes which are made with perfect precision increases.

The above results are also confirmed by further excavations directed by Prof. G. R. SHARMA in Chakia (Varanasi) and on Kaimurs.

ROOK-PAINTINGS OF MIRZAPUR

The rock-paintings of the Mirzapur district relate the story of man's cultural development from a very early time. The earliest paintings belong to the time when man was primarily a hunter and food gatherer. He lived in rock-shelters and used tiny tools. The latest paintings may be assigned to the early historic period when the use of chariots with spoked wheels, domesticated animals, caparisoned horses and elephants, and swords and spears was known.

The caves, hollows, and rock-shelters in which these paintings are found are of natural formation—some appear to have been hollowed out by the agency of water while the others are formed by overhanging rocks. The paintings have been done either in outline or in flat wash. The liquid or semi-liquid paint was spread, in all likelihood, with a brush or pad. Pigments of various colours have been used but the most common is ruddle, or red oxide of iron which occurs in a very pure form in the Kaimurs and Vindhyas. Lumps of it are found in the soils of caves. Some times paintings also occur in white, brown etc.

The rock art of Mirzapur is dominated by hunting scenes. Single human figures are rare. They have either been depicted with animal figures in the action of hunthing or performing some ritual dance. In some of the shelters certain symbols consisting of dot and line, geometric figures etc. have also been painted.

From the point of view of technique of presentation, state of preservation and superimposition, all the paintings can be grouped in a number of categories. The paintings of the first group, which are the earliest, may be termed as Immitative or Naturalistic. The stress in them is on the faithful reproduction of the subject. The animals are depicted in natural attitudes. There is no human figure or hunting scene that can be placed in this group. The colour is burnt red and the figure is larger in size. Such paintings are always covered with a thin coating of patina and underlie paintings of later periods.

To the second group belong the larger number of paintings which may be termed as stylised or suggestive. These are neither lifelike nor photographic reproduction of the original. No care was given to proportion. The artist was satisfied by drawing merely the resemblance. Sometimes the curves of the body

were reduced to mere straight lines and angles only. The paintings belonging to this group show a variety of subjects—single animals, animals in small groups, hunting scenes, trap scenes, animals with riders, human figures, etc.

To the third category belong Paintings that may be termed symbolic or cubist. Cubism is so abstract that the pictures are sometimes reduced to an angle, a circle, a dot, a spiral line, or a loop. What actually the individual figure represents is difficult to say.

Besides the paintings discussed above which are always painted in red, there is another group that are executed in dirtyish white. Technically they come closer to the paintings of stage two but chronologically these are later because they always superimpose the red ones.

There is yet another group of paintings which is totally different from those mentioned so far. These no longer revolve around animals or depict hunting scenes or trap scenes, etc. Instead, they depict elaborate war scenes long kingly processions, etc. The other representations are of yoked bulls, horses with chariots, caparisoned horses and elephants with riders, huge human figures sometimes with swords and spears, and alpana designs etc. The colour also differs, being more organish then red. On the basis of subject matter, technique and the fresh look the paintings of this group may be placed in the early historical period.

G. R. Sharma :

I am putting before you the results of our excavations of microlithic sites in the Mirzapur district. Kaimurs, a part of the Vindhyas abound in rock-shelters with paintings and open air settlements, rich in microliths. The Institute of Archaeology carried out a preliminary investigation last year, when two rock shelters and one open air settlement were taken up for excavations. This year the rock shelter in the outcrop known as Lekhahia, and open air settlement around this outcrop situated at a distance of 69 kilometers from Mirzapur to the east of Mirzapur-Rewa Road, were selected and trenches were laid in two rock shelters, LKH-RS1 and LKH-RS2 and three open air settlements LKH-1, LKH-2 and LKH-3.

The two trenches LKH-1 and LKH-3 measuring, 7m. × 3m. each, situated to the south of the Rock Shelters yielded almost indentical results. The total accumulation of about 1·1 m. above the original bed rock, was divisible into 9 layers, which from the evidence of colour and composition etc. seemed to have been deposited under different climatic conditions.

The implementiferous deposit consisting of layer 8 to 1 affords evidence of four stages in the evolution of the microlithic industry of the site. The microliths from the layers 8 to 7, consisting of unretouched blades, blunted-back blades, points, lunates, scrapers, and a very large number of cores and unfinished tools in various stages, mostly fashioned out of chert nodules, represent the earliest phase of the microlithic industry in the area. The antiquity of the tools is attested to by very heavy patination.

The microliths from layers 6 and 5 consisting mostly of non-geometric tools, typologically similar to the tools of the earlier period, but also containing geometrical

tools i. e. triangles, represent the second stage. These two layers did not yield any pottery.

Layers 4 to 1 yielded geometric tools, comprising triangles and trapezes and pottery, the percentage of which shows a progressive increase. The tools from these four layers represent two stages in so far as the size of the tools is concerned. Layers 4 and 3 have yielded tools of large size whereas from layers 2 and 1 diminutive tools were also found.

The above stratigraphy was also partly confirmed by the excavation of LKH-2, a trench measuring 6·2 m.×3·1 m. laid to the north-west of the rock shelter 1. The habitation deposit comprising three layers 3B, 3A, 2 and 1 was 48 cms. in thickness. Except the top layer 1, the rest of the layers represented the first phase noted above and yielded pre-pottery non-geometric tools. Layer 1 also did not yield any pottery, but only a piece of triangle was discovered from this layer.

The excavations of the three open settlements, thus establish the following sequence of the microlithic culture in these parts of the Kaimur.

Phase I—Non-geometric pre-pottery microliths, heavily patinated.
Phase II—Geometric tools without pottery.
Phase III—Geometric tools with pottery.
Phase IV—Geometric and diminutive tools with pottery.

LEKHAHIA ROCK SHELTER I

The rock shelter, measuring 11 m.×10 m. had a thick habitational deposit. There are a few paintings on the walls but immediately above it there is a very large group of paintings, which on the basis of styles, theme, colour and technique, could be divided into more than one group. Some of the paintings are only in outlines, in some cases part of the body is filled with vertical lines whereas in some other cases, entire body is filled with colour.

A trench, measuring 5·2 m.×2·5 was laid in the shelter towards the inner half and the excavation revealed habitation deposit with an average depth of 43 cms. Seventeen skeletons were exposed, each one of which was laid on the back in an extended position in a grave, the vestiges and outlines of which were clearly marked in many cases on the bed-rock.

All the seventeen extended burials have yielded plenty of microlithic tools, flakes, cores etc. evidently used as grave goods. On the basis of the stratification, actual super-imposition of one burial upon another and overlapping of the graves, 14 out of 17 skeletons have been assigned to 8 periods. It is as follows :—

Period	Skeleton
I	II
II	III
III	IV
IV	V, VIII, IX and XI
V	X, XII and XIV
VI	XIII and XV
VII	XVI
VIII	XVII

The skeletons numbered as I, VI and VII were found in a very fragmentary condition and their stratigraphy was so disturbed that they could not be assigned to a definite period.

Partly because of the disturbance caused by subsequent graves and partly on account of compression caused by the sinking of the rocks, the skeletons, specially the skulls were badly crushed, but with the exception of the skeletons numbered as I, VI, VII and XVI, substantial portion of the body of other skeletons was recovered. However, the skulls of skeletons I, II, XII and XIV were completely missing. Of the skull of skeleton XVI only a small portion was found. The skulls of the skeleton III, IV, V, IX, X, XI, XIII and XV were found *in situ* and could be reconstructed. Of the skull of the skeleton XVII, however only a few fragments, though found *in situ*, could be recovered. From the fragments of the skulls of the skeletons VI and VII, the skulls could be reconstructed.

In no case, all the limbs of the body were found intact.

With the exception of skeletons numbered as II and XII, all were oriented in west-east direction with the skull lying towards the west. Of the two other cases in one the orientation was north-south and in the other south-north.

The excavation of the shelter has revealed that the first occupants levelled the bed-rock with the help of material from the non-implementiferous layer numbered as (9) of the open-air settlement. This material used as the first pavement didn't yield any microliths. According to the evidence of the microliths, burial XVII, the earliest in the series, belongs to the non-geometric pre-pottery phase of the microlithic industry. The rest of the skeletons yielded both non-geometric and geometric microliths.

The bones of the earliest skeleton showed heavy incrustation. Even the microliths were heavily incrustated and either were affixed to the bone or found in small lump. There was an evidence of incrustation, though not to the same extent, in other cases as well. The skeletons, specially XVIII, show some calification.

PAINTING MATERIALS FROM THE BURIALS

The skeletons III, XI, XII, XIII and XIV have yielded materials which could have been used as colour for paintings. The material comprises ochre and weathered lateritic nodules. The discovery of this material together with microlithic gravers and bone tools afford circumstantial evidence about the links between the burials and the paintings in this area.

The excavations of the rock shelter provide evidence of extensive disturbance which brought to an end the microlithic industry in this area. The shelter is disturbed by extensive pits which yielded pottery together with copper beads and iron arrow heads, suggesting clearly the impact of a people in a different cultural stage. The close identity of this pottery from this pit in type, material and fabric with the pottery from the megaliths from the Belan at the foot of Kaimur situated only at a distance of 16 kilometers from the shelter, clearly points towards the megalithic people as the destroyers of these microlithic settlements.

ROCK-SHELTER II

The Lekhahia Rock shelter 2 is situated to the northern side of the Rock shelter 1. It is a small shelter measuring 3 m. × 2 m. The excavations have shown habitation deposit only 20 cms. in thickness comprising four layers in an excellent stage of stratification. The shelter was occupied by the microlithic people of the geometric and pottery stage.

Thus the excavations of two rock shelters show the same cultural sequence as in the case of the open air settlement.

PRE-MICROLITHIC HUMAN (?) AND ANIMAL REMAINS

The trench in rock shelter 1 brought to light a pit cut into the original rock-bed and sealed by the non-implementiferous deposition with which the cave was plastered, evidently by the makers of the microliths on their first arrival in the area. This pit yielded fragments of what seems to be the pieces of two human skulls and one animal mandible with teeth. These are in an advanced stage of fossilization and if a scientific examination ultimately confirms these pieces as fragments of human skulls, this will be the first discovery of the premicrolithic man.

G. C. Mohapatra :

While dealing with the distribution pattern of the Mesolithic sites, Dr. MISRA has said that the "territory between the Kirshna and the Mahanadi is largely a *terra incognita*". This is not quite true as Sri KRASHNASWAMI reported microliths from the Bastar area of this region, and north of the Mahanadi microliths have been collected by Mrs. D. MISRA and myself from Dhenkanal, Sundergarh and Mayurbhanji districts of Orissa.

Strictly speaking only one site i. e., Langhnaj, to some extent, meets the definition of a Mesolithic site. Rest are all non-geometric microlithic sites with or without pottery. Now, it is almost a certainty that there is a phase in India when only microlithic artifacts were produced, mainly non-geometric, and the art of pottery making was unknown. That phase is represented at *teris*, Birbhanpur, Orissà, Sanganakallu, Jalahalli, Adamgarh, and even at Langhnaj (earliest phase). I shall suggest that only these industries should be considered as Mesolithic and those yielding pottery should be grouped separately until we are in a position to distinguish between the hand-made pottery of the Neolithic-Chalcolithic on one hand and that of the Mesolithic on the other. It is more likely that some of the non-geometric microliths with pottery are Neolithic rather than Mesolithic. In this connection the whole of the Deccan Trap region and southern Rajasthan is an area to be dealt with utmost caution. Here the transition between food-collecting and food-producing was perhaps a very very short-lived phenomenon.

Kenneth A. R. Kennedi :

The occurrence of facial prognathism and dolichocephaly in several human crania from Langhnaj has suggested to certain scholars that a "Negroid" or an "Hamitic" racial element is apparent in this Late Stone Age population. To Dr. Sophie EHRHARDT "Asiatic Proto-Mediterranena" and "Veddid" traits are

discernable. After having examined these skeletons, as well as the one I recovered from Langhnaj in 1963, I am led to concur with Dr. EHRHARDT that a "Mediterrenean" phenotypic complex is represented here. But the identification of African racial elements is not obvious to me. Facial prognathism and dolichocephaly are evident in many human populations and the physical anthropoloigst need search no further than the Indian Sub-Continent to discover these features among its living inhabitants.

Concerning the cultural remains from Langhnaj, I do not support Dr. ZEUNER's interpretation that the markings on the rhinoceros shoulder blade (now in the Department of Archaeology, Deccan College) are the result of this large bone having been employed in the manufacturing of microliths : similar grooves occur on certain of the human bones which, because of their fragility, could not have been used as anvils. A more reasonable explanation is that we have here the impressions of the teeth of a fossorial rodent.

Finally, I should like to point out that during the 1963 expedition to Langhnaj, I found, as did SUBBARAO in the 'fifties' crude grey potsherds in association with microliths at the lower so-called "Late Stone Age" level.Where the pottery diminished in frequency, so did the microliths until a completely sterile layer was encountered at about a depth of about 3 meters. As there is no appreciable size of type difference between these deeply buried potsherds and those potsherds recovered from immediately overlaying layers, their fortuitous infiltration into the bottom microliferous zone seems doubtful.

A. K. Ghosh :

Dr. MISRA has cited some examples from Indian tribes who are in the process of conversion from Mesolithic to Neolithic. But the Juangs of Orissa are, practically speaking, having a Neolithic economy—with shifting agriculture.

In his discussion on distribution of microlithic find spots the north-west Midnapur (a fringe of the Chhota Nagpur plateau), in West Bengal, should be included. In south Bihar, Singhbhum district and its adjacent districts have been extensively explored and a large number of sites have been discovered. From the distribution it may be said that the occurrence of microlithic sites in Singhbhum has nothing to do with the 'Copper belt' as pointed out by GORDON.

In Bihar, besides the types shown in Table I of MISRA's paper the following types should be included : triangle, trapeze, micro-burin and transverse arrowhead. There is no place for West Bengal in the table. Hence I request MISRA to include West Bengal with the types found from recent works.

In support of the term 'Mesolithic' I would like to place the following data from Singhbhum. In Singhbhum, microliths occur in post-Pleistocene deposits. Moreover, they are pre-Neolithic, as evidenced from the exploration and trial trenches in 'Sini area'. They are preceded by the flake-blade industries. Regarding the material, types and technique there are similarities. But the microliths are diminutive in size and are post-Pleistocene in date. So the genetic connection in the microliths indicates a homogenous group and a culture extension of the flake-blade industries.

Lastly, I would suggest that the Indian Mesolithic cultures should be viewed in a wider perspective. In this work the types, techniques, raw materials, associated finds and chronology should be included. Work on this line may throw light on the relationship of Mesolithic culture in relation to geology and physiography. Skeletal remains found from Langhnaj and recent discoveries in Mirzapur might show the ethnic group responsible for this culture.

P. C. Pant :

I have been exploring the southern parts of Uttar Pradesh, comprising Varanasi, Mirzapur, Banda, Hamirpur and Jhansi districts, for the last four years. During my work I have come across about two dozen factory sites of microliths. Almost all of them are situated in the vicinity of slopes of hills, with a river or a nullah flowing nearby. The implements are found mostly on the suface, occupational deposit being rarely more than six inches or so. Simple blades predominate, while fluted cores with pointed or sharp small chisel edge seem to be the characteristic core type. Triangle and trapeze are absent and lunate and backed blade, though present, are rare. Typologically the implements may be classed under' ribbon flakes' and are nearer to the Chalcolithic blade industries. All these industries are of homogenous character and may be said to belong to one culture. As these implements were found, probably for the first time in 1963, in excavation at Banimilia-Bahera in Mirzapur district in the context of pottery and megaliths, I prefer to call them 'Banimilian Microlithic Culture'. On the basis of pottery types, the earliest date of the megaliths of Banimilia-Bahera has been proposed as *circa* 1000 B. C. Here the implements were found just below the megaliths, and so *circa* 1000 B. C. may reasonably be regarded as the upper limit of this culture. Sri. R. K. Varma has also just now referred to similar implements, devoid of pottery, belonging to the earliest phase of Morhana Pahar, in Mirzapur district. Now, so far as a general term like Late Stone Age is concerned, we may of course put this culture under this head. But Mesolithic, I believe, is a more technical term, and only true microliths belonging to early Holocene may be attributed to this age. Misra following Grahame Clark maintains that only those blades can be termed as microliths which have been backed by secondary work. If this definition is followed strictly, the implements of 'Banimilian Microlithic Culture' cannot be grouped as microliths and so do not find any place in Mesolithic culture. At the same time, I may also add that these implements cannot be put under the so called Series III. Under these circumstances, my problem is to which age these implements should be attributed? Secondly, are we justified to apply European terms and conditions strictly on Indian Pre-history, without taking into consideration the geographical factors?

S. P. Gupta :

Dr. Misra wants to retain European terms, since according to him they are of wider application than they are supposed to be. The criterian of a term denoting a culture should be economy rather than technology, that is Misra's stand. However it may be pointed out that the terms Palaeolithic and Mesolithic in themselves

do not denote the type of economy archaeologists have attributed to each one of them. They denote only a sequence: old and middle. I do not understand what objection there can be to the new terms 'Early Stone Age', 'Middle Stone Age' and 'Late Stone Age' which equally denote a sequence. Further, it is also not true that those industries falling within the Pleistocene were called Palaeolithic and those in the Holocene, Mesolithic and Neolithic; for, the Upper Palaeolithic, in many countries, continued right upto 6000 B. C. or even later, well within the Holocene. Still more, the reconstruction of economy by interpreting the utility of tools found at a site is often more subjective than real. For the latter, concentrated efforts of different sciences of botany, zoology, climatology, etc. are needed which today we lack to a great extent in our country. Over and above all this, even our tool assemblages are not always the same as in Europe. The statement that once the tools on bone and wood had been there but did not survive because of our climate, does not lead us anywhere. It may be true but the approach is not objective. In my opinion, therefore, no single term in archaeology can be justified on all grounds. Let us say that more than the term it is the sense that we attribute to it that is important. Attributing a sense to a term is a matter purely of agreement either at a single sitting or through usage. In the present case since a terminology has beeen agreed upon and recommended by an International Committee, let us follow it; it may be correct in one sense and incorrect in the other; let it not bother us.

The problems of origin, stages of evolution, dating, duration and directions of movement of this culture in India are most tricky: only a few guesses have been made by LAL, ZEUNER, SANKALIA, and MISRA, but not many have been confirmed by further work in the field. I have observed a feature in the districts of Jabalpur and Mandla that has to be confirmed by more field work. In the vicinity of some Middle Stone Age sites, I found sites on the patches of land covered with black soil or, on hill slopes which produced hundreds of fluted cores of jasper, chert, etc. with short or long blades but never retouched and never with a single microlith as such. In areas round about, there is no Chalcolithic site. I, therefore, consider it as the earliest stage of the microlithic industries in India. It was preceded by Late Stone Age cultures and followed by non-geometric pre-pottery microlithic stage of Birbhanpur, *teri* sites, Morhana Pahar, etc. Sri. A. K. Ghosh informs me that he got stratified evidence of the first part of my theory in Mayurbhanj.

Regarding microburins I would like to inform the gathering that a few specimens of this type are present in my collection from Adamgarh rock-shelters, now in the National Museum.

CONCLUDING REMARKS

V. N. Misra :

I shall briefly touch upon the salient points made during the discussion.

Several scholars have questioned the justifiability of the term 'Mesolithic' and expressed their preference for 'Late Stone Age'. The subject, however, forms part of the wider question of the nomenclature of Stone Age Cultures and cannot, therefore, be discussed here in detail. I have expressed my views in full on the subject elsewhere (MISRA, 1962) and briefly during the discussion on Middle Stone

Age. Suffice it to say here that almost all speakers on the subject are agreed that the Mesolithic industries chronologically represent a phase between the Palaeolithic and Neolithic cultures, and that culturally they are similar to the industries classified as Mesolithic in Western Asia and Europe. As for the question of stratigraphical proof of the position of Mesolithic industries in relation to Neolithic and Chalcolithic cultures, we have clear evidence from Sangankallu, Rangpur, and Kuchai. It should also be remembered that even outside India sites yielding a continuous succession from Palaeolithic to Neolithic are few and far between. Most of the Mesolithic sites are one-period sites and have to be assigned to Mesolithic on cultural factors alone.

The microlithic industries from south U. P. reported by Sri. P. C. Pant appear to be similar to those of South Rajasthan and unless they are associated with Chalcolithic, Neolithic or later material, they should be ascribed to 'Mesolithic'.

On the relationship of microliths and paintings I have nothing fresh to add since the published evidence is both scanty and obscure and I have very little first hand acquaintance with the subject. I had mentioned the subject in the hope that scholars having direct acquaintance with the subject will throw some light on it.

The same applies to microburins. I had mentioned them in the table as they have been reported by some workers and as I had not seen the specimens myself, I was not in a position to adopt any other course.

Finally, I agree with Sri Thapar's suggestion that the relationship between Mesolithic stone industries and Chalcolithic-Neolithic blade industries in different regions should be investigated. Now that adequate material is available, quantitative studies of this type are feasible. They will show in what measure the local Mesolithic communities contributed to the technology of the early agricultural communities.

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NEOLITHIC PROBLEM IN INDIA

B. K. Thapar:

INTRODUCTION

Early in post-glacial times, an important change was taking place in human evolution; man began to control his environments and was thus enabled to settle down in villages *effectively*. He was tied to land and had sacrificed his liberty for the sake of security. The food-gathering or hunting economy of the Mesolithic forbears of late Pleistocene times gives way to one of deliberate food-production involving husbandry and stock-raising. This change in human economy constituted what has been termed as "Neolithic Revolution", and took place in different areas over a great range of time. As such, it is not a specific time phase falling between exact dates but represents a stage in economic and technological development. Other traits often associated with this new way of life are the grinding and polishing of tools and the manufacture of pottery. The craft of potting, in the light of recent excavations in West Asia, is, however, proved to be no longer an essential attribute of this culture. The use of metal was unknown in the typical neolithic economy.

With a view to emphasize the aspect of cultural and natural historical reconstruction in such studies, Braidwood advocated substitution of the Grecised term "Neolithic" with the 'appearance of the effective village farming communities'. The latter, he believes, 'is a fuller and more precise term for the broad social changes which the transition brought about'. In India, data of ancient environment is sadly lacking and all the *eras* of the food-producing stage as contemplated by Braidwood have not been determined. As such the term 'Neolithic' is still retained to designate cultures which are associated with the ground and polished stone axes and adzes.

The purpose of this paper is to study the emergence and spread of these cultures in India and incidentally to ascertain their *level* of economy.

THE BACKGROUND

Emergence of neolithic cultures in the ancient orient:

It has been suggested that a region with a natural habitat zone of wild plants and animals, both possible and ready for domestication, would be a *nuclear area* for the beginning of food production. The nuclear area of Western Asia, with which we are concerned, lies in the hilly-flanks of the Zagros, Turus and Lebanon Amanus ranges at elevations ranging between 700 and 1600 metres and comprises rain-fed park-lands suitable for agriculture based on rainfall alone. The animals which are domesticated were at home in this zone in their wild state. The natural environments, therefore, were ready in this area. The transition from a hunting economy to that of food-producing can be seen on a number of sites in West Asia. The momentous change beginning somewhere in the latter half of the eighth millen

nium B. C. gradually spread outwards. To follow the main stream eastwards examples must suffice here. In the Natufian we have an evidence of a predominantly hunting people beginning to harvest grains, etc. The evidence is carried further at Jericho, an oasis in the Jordan valley and at Qalat Jarmo in the Kurdish hills in the Tigris drainage. Chatal Huyuk in the Konya plain and Hacilar, both in the Anatolian plateau, afford parallel developments of pre-pottery Neolithic cultures. Belt and Hotu caves, above the southern shores of the Caspian sea, show succession of Mesolithic and Neolithic occupations, but without a continuity between the two; Guran Tepe south of Kermanshah in Luristan, shows a succession commencing from the aceramic cultural phase through the Neolithic with Sarab and Jarmo Wares. East of the Caspian, Djeitun, recently investigated by the Russians, is another early Neolithic settlement dating well back in the fourth millennium B.C. From here farming communities penetrated slowly eastward towards Baluchistan and the Indus region. At Kili Ghul Mohammad near Quetta there is evidence for a prepottery Neolithic occupation (3690 ± 85 and 3510 ± 515 B.C.) dependent on domestication of animals and agriculture.

This rapid survey suggesting the spread of the food-producing economy from the nuclear area of Western Asia may not be taken to have complete diffusionary implications. Other natural habitat zones or alternative models need further investigation.

To the situation in India, we may now turn.

MATERIAL EVIDENCE

The first find of a neolith was reported as early as 1842 in the Lingsugur area of district Raichur in Mysore. Ever since then a large number of these implements have been collected from various part of India. Interest in the neolithic implements or the age or cultural equipment which they represent was restricted mainly to a speculative level. It was not surprising, therefore, that workers in the field should have been led to conclude that 'in India there is no positive, archaeological proof for the existence of the Neolithic peoples at any time before or after the use of metal was introduced in that country,' or 'at present the term 'Neolithic' or 'New Stone Age' does not make much sense in India.' During the last decade or so much systematic work has been done to place the Indian Neolithic Cultures in their proper perspective, chronological and cultural. Three principal Neolithic regions—northern, southern and eastern have been recognized. Apart from the common element of ground and polished stone tools, the assemblages in each region are different, alike in cultural content and chronological span. A fourth Neolithic province for the Deccan trap area of central and western India has also been advocated. But, in view of the absence of a sharp distinction between the Chalcolithic and Neolithic cultural stages manifested in these assemblages, the above postulate is not being considered here. Nevertheless, it must be admitted that the economy of these Chalcolithic cultures rested on mixed farming, which in itself is a Neolithic trait.

NORTHERN NEOLITHIC CULTURE

This culture as represented at Burzahom and a few other sites in the Jhelum valley of Kashmir shows certain unique characteristics which single it out from the other Neolithic cultures of India. Four seasons of careful work at Burzahom have revealed two phases within the Neolithic occupation.

In the earlier phase, the inhabitants lived in circular or oval pits dug into the *Kerewa* soil. Evidence of landing steps and niches in the sides of the pit and deposits of ash, etc., on the pit-floors confirms their use for dwelling purposes. The traces of post-holes along the edge of the pits suggest the existence of timber superstructures. Their way of life seems to be primitive. Besides polished stone implements, they made effective bone tools including awls, needles, points, chisels, harpoons, etc. Their pottery was largely hand-made and showed mat-impressions on the under side of the base.

In the succeeding phase, pit-dwellings were abandoned and structures of mud and mud-bricks were built on ground level with plastered floors, often coated with red ochre. A new ceramic with black burnished surface made its appearance. Another innovation in the craft was the introduction of the potter's wheel. Polished stone axes and bone tools came to be used in larger number. Knowledge of metallurgy was acquired towards the close of this phase, the evidence, however, being confined to a lone example perhaps of a copper arrow head.

Burials, of which evidence was available from phase II alone, showed both primary and secondary interments, the former containing extended articulated skeletons and the latter only partial, viz. selected bones. In the graves, domesticated animals like dog and goat or their bones were often deposited along with human skeletal remains. Instances of trepanning the skull, suggestive perhaps of their magico-religious beliefs, are also found. Animal burials also showed both articulated and fractional (incomplete) skeletons, the animals represented being dog, wolf and ibex. One of the burials contained skeletal remains belonging to five wild dogs and antler's horn. The burials, both human and animal, were found within the habitation area itself.

There is no positive evidence for the cultivation of cereals. Nor are any grinding stones found in token of their use. The curious 'harvesters' (stone knives) and the ringstones or mace-heads alone imply knowledge of husbandry, the evidence being more indicative than conclusive. The bone industry on the other hand suggests a stage during which hunting still had a prominent place. Radiocarbon dates indicate a horizon in the first quarter of the second millennium B. C. for the early phase of this culture.

How far did this Northern Neolithic Culture with its characteristic traits extends southwards in the valley of the Beas still remains to be ascertained by further explorations. In the meantime, the recent find of polished stone celts including a fragmentary ringstone from the Banganga valley in Dehra Gopipur Tahsil of Kangra District is very tantalizing.

SOUTHERN NEOLITHIC CULTURE

This culture represented by the scatter of sites in Deccan including the Karnataka region has attracted the greatest attention of the archaeologists. During the last fifteen years or so as many as eight sites have been excavated. Brahmagiri; Sanganakallu; Piklihal; Maski; Nagarjunakonda; Utnur; T. Narsipur and Tekkalkota. It is a measure no less of the homogeneity of the culture as of its stability that the results brought forth by each of these excavations have been, save for certain minor differences in detail, strikingly similar.

The earliest manifestation of this culture is seen at Sanganakallu where, in Phase I of the occupation, a large number of heavily patinated flakes of trap and sandstone associated with crude microliths of quartz and chert were found, there being no evidence for the use of pottery. This occupation was separated from the succeeding Neolithic phases by a sterile layer. Although the latter cannot be said to derive from the former, the existence of a pre-pottery horizon with flakes and microliths at this site is not without significance.

The succeeding phase, which marks the fully developed stage of the Neolithic culture, shows two sub-phases based largely on the evidence of associated pottery. The lower sub-phase is characterized by a pale-grey ware with a few pieces of the coarse brown and black wares. In the upper sub-phase, the coarse brown and black wares become dominant, the pale-grey ware, however, continuing in smaller numbers. Besides, a few painted sherds were also found.

Polished stone implements comprising axes, adzes, pounders, chisels, slick-stones or polishers, slingstones and microliths with a bias for the parallel-sided blades form the other associated industries of this phase.

At Piklihal, Brahmagiri and Maski, however, painted sherds occur in the lower strata of the Neolithic occupation. This needs further investigation notably from the point of view of the origin of this painted pottery. Another noteworthy evidence provided by Brahmagiri and Piklihal, and not present at Sanganakallu, is the occurrence of copper in the upper strata of the Neolithic occupation marking perhaps the contact of the Southern Neolithic Culture with the Chalcolithic cultures of the Northern Deccan.

With this sequence we might now recount the essential traits of this Culture.

The ceramic is characterized by a dominant handmade dull grey ware showing burnished surface and represented in simple unvarying forms. Along with this a brownish red ware with shades of buff is also present. Painted pottery showing simple linear patterns in brownish purple colour and incised decorated ware occur in small numbers. Excepting Sanganakallu, their horizon is in the lower levels.

The lithic industry represents the typical ground and polished stone implements including pointed-butt axes, shoelast hoes, adzes, wedges, hammers, chisels, picks, pounders, grooved hammerstones, mace-heads or ringstones, grinding Stones, etc. They are mostly on trappoid or basaltic rock.

The so-called microlithic industry shows a marked emphasis on the production of blades. As a rule there is very little secondary work. Tools showing secondary work form only a small percentage and include : blades, serrated, backed or knife-shaped; lunates; trapezes; points, etc. This industry occurs from the very start of the neolithic occupation on each site excepting at T. Narsipur from where only one example of a fluted core was obtained.

Other miscellaneous crafts include working in bone and manufacture of beads. Examples of worked bone points and chisels, are known respectively from Piklihal and Utnur.

Both inhumation (extended articulated) and urn burials were in vogue the latter perhaps intended for children whose bodies had been tightly folded to fit into the restricted space. The grave-goods in the former type of burials include pottery and occasionally blades and polished stone axes. In the latter category save for a lone example of a bronze pin obtained from one of the burials, no accompanying objects are recorded. The burials are found within the habitation area itself.

That the economy of these Neolithic people was pastoral is amply demonstrated by the animal remains of the domesticated cattle, buffalo, sheep and goat. This is further supplemented by the structural remains of a cattle-pen with stockade, etc., exposed at the Utnur ash-mound. The evidence of successive burnings recorded at this mound adds precision to the earlier observations that the cinder mounds represent accumulations of cattle-dung.

Radiocarbon dates have indicated a range between 2000 and 650 B. C., somewhat later if Brahmagiri dating has to be taken into consideration.

EASTERN NEOLITHIC CULTURE

Of the Neolithic complex of east India much has been written. Most of it relates to the origin and distribution of the characteristic tool-types known as faceted hoe, shouldered hoe, splayed axe, bar-celt, roundedbutt axe, etc. In the absence of systematic excavation in the region these studies have largely remained speculactive, confined to typological comparisons and generalised inferences. Full components of the culture which these tools represent have, therefore, remained ill-defined. Within the framework of the present paper, it is not intended to re-traverse the ground in regard to the close relation of the southeast Asian, Chinese and Indian evidence. Suffice it to admit that there is enough evidence to suggest an Eastern origin with a bias for central China for the specialized tool-series with oblong or rectangular cross-section.

Recent excavations at Kuchai, District Mayurbhanj in Orissa and Daokajli Hading and Daojali-Parbat, United District of Mikir Hills in Assam and explorations in the Sanjay Valley, District Singhbhum in Bihar have, however, provided the much-needed substance to the Eastern Neolithic Culture.

At Kuchai, a coarse girt-tempered red ware, sometimes also slipped and showing incised or finger-tip decoration was found in association with polished stone implements. The latter comprised rounded-butt axes, faceted hoes, chisels,

pounders and fragmentary examples of a mace-head and a grinding-stone. No shouldered hoe was found from the excavation although it has been reported from the area as a surface collection. There was no evidence for the use of metal. From the present limited evidence, it is rather difficult to reconstruct the economy of the Neolithic people of Orissa. The stone axes would be used for forest clearings with a view to farming while the existence of pounders, grinding-stones, etc., may imply acquaintance with husbandry.

At Daojali Hading, the pottery found in association with the Neolithic implements was greyish in colour and often showed basket-and-cord-impressions on the exterior. The implements comprised : celts including one of shouldered variety; hoes; corn-grinders; mullers; pestles, etc. Here again, there was no evidence for the use of metal. The assemblage indicates a similar economy as that of Kuchai.

It will be seen that the ceramic industries in each region are different. Does it mean that diffusionary impulses were received in each region independently ? And, does it fit in with the postulated grouping of the East Indian Neolithic complex into two regions : Assam and Bengal-Bihar-Orissa ? Perhaps there is more in it than we can at the present moment evaluate.

Now let us pass on to the date. Little exact information is forthcoming from either of these excavated sites, regarding the date of the Neolithic occupation in eastern India. The judgment is further confused by the continuance of implements of this series into historical times. The latter occurrences, however, seem to represent the survival of a tool tradition and do not belong, strictly speaking, to a 'Neolithic economy'. To the evidence already documented for the occurrence of polished stone implements of this series, we may now add the one furnished by the excavations at Pandu-rajar-dhibi, District Burdwan in West Bengal. Here, excepting a doubtful example from Phase II, polished stone axes occur in Phase III which by sequence dating (based on a radiocarbon date of 1012+125 B. C., for Phase II) could be assigned to the earlier half of the first millennium B. C. The occurrence of these axes is in a stratum where knowledge of copper and seemingly iron too was attested. On the other hand the occupations both at Kuchai and Daojali Hading belong to a period when metallurgy was not commonly practised in that area. In that sense they are typically Neolithic. In view of the presence in their respective assemblages of advanced types like shouldered hoe and faceted hoe, a much earlier horizon than 1000 B. C. cannot be postulated for this phase of the Neolithic culture.

DISCUSSION

The results set out above in the study of Neolithic cultures in India permit some general conclusions to be drawn.

The Northern Neolithic Culture has a unique assemblage quite unlike that of the other Neolithic cultures of India. It was previously thought that the Neolithic phase of Kili Ghul Mohammad might have inspired the 'loessic Neolithic

industry of Kashmir.' However in view of the close resemblances of certain tool types, notably the harvestor (semi-lunar or rectangular knives) in the Neolithic period of China and Japan we are now led to look towards East for the diffusionary impulses. Besides the use of bone implements and the practice of pitdwellings are elements quite familiar with the Neolithic cultures of the East. At Burzahom or in the explored area of the Jhelum valley, no antecedent stages of this resemblance other than that of diffusion can, therefore, be conceived at the present moment. A date in the first quarter of the second millennium B. C., has been assigned for the earlier Phase of the Northern Neolithic Culture in India. This is fairly consistent with the chronology of the Neolithic periods in China and Japan. In the Shang Period (latter half of the second millennium B. C.), which marked the appearance of the Bronze Age, the harvester type survived along with the shouldered celt. Since no shouldered celts are known from Burzahom, it is arguable that the harvester type had reached Kashmir before the Shang Period.

The Southern Neolithic Culture with its characteristic pointed-butt axe industry and the burnished grey ware seems to have originated in the region itself. An essential trait of this culture was a microlithic and blade industry. How far are such types as lunate, trapeze, point, worked blade, etc., derived from similar forms of the pure microlithic series of the Late Stone Age requires closer observation. The vital need, however, is to investigate whether there was any continuam of microlithic tradition from the aceramic geometric series into the Southern Neolithic complex.

The Eastern Neolithic Culture, distinguished by the occurrence of rounded-butt axes and other specialized tools, the latter perhaps involving metallic technique of manufacture, is inspired by the Neolithic and later tradition in China and south-east Asia. Both in the method of manufacture and in the form, these tools are different from those of the Southern Neolithic culture. Furthermore, the associated ceramic industries of each culture are basically different from the other. The two cultures, therefore, should be considered as distinct entities. Evidence for husbandry and stockraising is still wanting from the region. For the chronological horizon also more data is necessary.

From the foregoing it is apparent that our real understanding of the Neolithic problem in India is far from precise. Not many Neolithic sites in the sense of permanent settlements economically based on the practice of agriculture and domestication of animals but without a knowledge of metallurgy, have been systematically and extensively excavated with the result that the beginnings of the Neolithic farming economy have remained ill-defined. Where in India did this all important change took place is equally uncertain.

The loess mound at Langhnaj, in the Sabarmati valley, possesses a culture which represents a predominantly hunting economy but through the find of grinding-stones, mace-heads and pottery holds out possibilities for the change from the 'terminal era of food-collection to the incipient era of cultivation.' How far ancient environments including climate and general ecological conditions favoured this postulated transition still remains to be ascertained by the natural scientists.

At Kuchai in the Burhabalang valley in Orissa, a purely, microlithic occupation of Late Stone Age, practising a hunting economy, was succeeded by a Neolithic one. Yet there is no clear continuity between the two : The Neolithic culture cannot be said to derive from the microlithic.

At Sanganakallu, District Bellary, a pre-ceramic flake assemblage was followed after a break in occupation, by a fully developed Neolithic one. Again there is no continuity between the two Neolithic phases.

Further work in the areas enumerated above is, therefore, necessary to study the beginnings of the Neolithic economy.

We have still to find 'Natural habitat zones of potentially domesticable plants and animals' within our own borders.

V. N. Misra:

I shall confine my comments only to conceptual aspects of Sri THAPAR's paper. These are : (i) definition of the term Neolithic; (ii) metallurgy and (iii) origin of Neolithic in India.

Sir John LUBBOCK in 1865 when he divided the Stone Age into two periods, the Palaeolithic and the Neolithic, had proposed the following criteria for Neolithic cultures : (i) association with recent fauna as against the extinct fauna of the Palaeolithic; (ii) the shaping of tools by grinding in addition to chipping as against mere chipping in the Palaeolithic; (iii) practice of agriculture and domestication of animals.

Since then the definition has undergone much refinement and elaboration in the light of increased knowledge of lithic cultures in various parts of the world, and this can nowhere be better seen than in a series of authoritative books and papers by Prof. GORDON CHILDE According to Prof. CHILDE (1957), Neolithic is essentially an economic term, and it is the third criterian of LUBBOCK which is the most important. He has, therefore, suggested the replacement of the first two by the third one. In brief, he defines 'Neolithic' as 'a self-sufficing food-producing economy'. This definition implies the following traits.

1. A food-producing economy dependent on the domestication of animals and cultivation of plants. Hunting and food-gathering, however, continue though in a subsidiary role.

2. Sedentary nature of habitation-best exemplified in tells or mounds sometimes rising to a height 30 m. or more and covering at times several acres.

3. Absence of dependence on trade for essential commodities. Though sporadic trade in luxury goods might well be present as was the case even with some of the Upper Palaeolithic and Mesolithic communities.

4. Absence of full-time specialists in the society.

Thus, in India only those cultures which conform to these criteria have to be classified as Neolithic. THAPAR does not make it clear whether he uses the term 'Neolithic' in an economic or a technological sense. He begins his paper with an introduction on the emergence of food-producing economy in Western Asia and mentions a number of sites where the change from food-gathering economy to food-producing economy is discernible. However, he is conspicuously

silent about the existence and position of ground stone tools at these sites. Not even incidentally does he mention them. Thus, apparently THAPAR regards 'Neolithic' as an economic phase as far as Western Asia is concerned.

But coming to India, THAPAR sets the consideration of food-producing economy aside and restricts his consideration almost entirely to ground stone tools. Of course, objects associated with ground stone tools do come under his consideration, but only as subsidiary to the latter. The three Neolithic cultures, viz. the Northern, the Southern, and the Eastern, developed, according to him, in complete isolation from each other and had independent origins. He does mention that farming communities from Western Asia penetrated slowly eastward towards Baluchistan and the Indus region, but they seem to have stopped there. Since THAPAR does not recognize the existence of Neolithic cultures in Rajasthan, Central India, and the northern Deccan, he cannot derive the Neolithic of the Southern Deccan from Western Asia and arrives at the logical conclusion that the Southern Neolithic culture should be of indigenous origin. To the full implications of this theory we shall return later.

THAPAR's conviction that technology is the only deciding factor in the definition of Neolithic is more clear when he refers to metallurgy. He excludes the village cultures of the Deccan trap area of central and western India from the purview of the Neolithic because of the presence of copper among them, although he does concede that the 'economy of these Chalcolithic cultures rested on mixed farming, which in itself is a Neolithic trait'.

But then, copper is present at Brahmagiri, Piklihal, Tekkalakota, Burzahom, and Pandu-rajar-dhibi. And in the Eastern Neolithic the existence of types like the faceted tool, the shouldered tool, the splayed axe, and the bar-celt does imply knowledge of metal, for not only these tools themselves are imitations of original metal types, but some of them actually required, as THAPAR himself admits, the use of metal for their production. How can these sites be included in the Neolithic when according to THAPAR metal does not occur in a typical Neolithic culture ?

However, once we admit that it is the economy rather than technology which is the diagnostic trait of the 'Neolithic', all the village sites from the hill valleys of Baluchistan to the southern Deccan (including of course those in the Indus valley, Rajasthan, Central India and the northern Deccan) will have to be called 'Neolithic', for economically they represent the same stage. The presence of a few copper object does not imply any significant change in the economy. On this subject I may be permitted to quote the views of Prof. Gordon CHILDE (1957, 195-96) at some length.

" ....Copper objects as such no more mark the end of the Neolithic economy than does any other exotic substance. Pins from Badari and Sialk I made probably from native copper mean no more sacrifice of self-sufficiency than do the Red Sea shells and turquoise beads from the same sites. Imported copper objects as much as imported Mediterranean shells have been found on European sites that have always and justly (italics mine) been regarded as Neolithic.

And so, of course, have copper axes and even daggers as the Middle Neolithic Danish hord......... " Continuing the argument further he says : " A regular use of copper such as should mark the end of the Neolithic can be attested only by the findings of metal gear buried in graves or by traces of metal working (slags, crucibles, etc.,) in settlements. The one shows that metal supplies were regular enough to equip at least some members of the community with the indispensable armaments, the other that the village could support and supply a full-time professional smith ".

Strongly recommending that the Chalcolithic is to be included under the Neolithic, Prof. CHILDE observes :

" To introduce a special term at the point when stray objects of native or even smelted copper make their first appearance in any region would seem illogical. Accordingly Neolithic will include in Egypt not only Merimde and Fayum but also the Badarian and Amratian and in Mesopotamia the whole Hassuna-Halaf range. It should include even Ubaid if FRANKFORT's view be correct that the clay axes, knives, and sickles were substitutes for, rather than toy imitations of the metal ones they copy. "

THAPAR's use of the term metallurgy is far from exact. The existence of metallurgy implies not merely the possession of metal tools, but the actual smelting and working of metal. The presence of a single copper arrow-head at Burzahom no more implies the knowledge of metallurgy on the part of Burzahom folk than does the use of a wireless set by a barely literate villager imply the knowledge of electronics on his part or that of his community. The former was obtained by trade in the same way as is the latter. There is indeed very little evidence that outside the Harappan cities regular metallurgy was practised at any of the village sites, with possible the exception of Ahar in southern Rajasthan.

Finally, the origin of the Neolithic cultures. According to THAPAR the Northern and Eastern Neolithic Cultures are derived from China. This conclusion or suggestion is based on the common existence of blade and bone tools, and pit-dwellings in Kashmir and China. But THAPAR does not explain the origin of the ground stone tools in Kashmir which in his definition of the ' Neolithic ' constitutes the principal diagnostic trait.

The Southern Neolithic Culture, according to him, seems to be of indigenous origin. The traits of this cultures are : (i) use of ground stone tools; (ii) cultivation of cereals (as now known from Tekkalakota); (iii) domestication of cattle, goat, and sheep; (iv) use of pottery, plain as well as painted; (v) use of bone tools; (vi) use of blade tools; (vii) living in stone or mudwalled as well as wattle and daub houses; and (viii) burial with or without urns. At all the sites excavated in the Deccan all these traits appear in their full-fledged form, and there is not a shred of evidence to indicate the faint beginnings and patient growth of any of them at any site. How can then this culture be said to have originated indigenously ?

THAPAR mentions the Mesolithic site of Langhnaj as holding out ' possibilities for the change from the terminal era of food collection to the era of incipient cultivation'. He is evidently wrongly informed on the Langhnaj culture.

There are no ' grinding stones ' at Langhnaj. A few pieces of a quern-like object were found there, but they are too small and thin to serve the purpose of corn-grinding. Only one ring-stone has been found at Langhnaj, but ring-stones with microliths have also been found at other sites, for instance, near Bombay. The evidence for pottery in the lowermost levels of Langhnaj is uncertain, but even granting that it is there, the fact remains that it is not an essential Neolithic trait. In the upper levels of the site copper and iron occur along with microliths and there is nothing to suggest a transition from Mesolithic to Neolithic here. Besides, what about the ground stone tools at Langhnaj ? And what relationship has Langhnaj in space with the three Neolithic provinces defined by him ?

He further says that ' in India data of ancient environment is sadly lacking and all the areas of the food producing stage as contemplated by BRAIDWOOD have not been determined.' He concludes his paper saying : " Further work in areas enumerated above (Kashmir, Bengal, Orissa, Gujarat and the Deccan) is, therefore, necessary to study the beginnings of the Neolithic economy. We have still to find ' natural habitat zones of potentially domesticable plants and animals within our own borders.'

The data of ancient environment is sadly lacking in Western Asia too, for serious research on the subject has only recently begun there (BRAIDWOOD and HOWE, 1960; BRIADWOOD, 1962). The pronouncements on the subject in the earlier literature were almost all speculative. Anyway, the environmental data can help us explain the archaeological evidence once we know it but they cannot be a substitute for the latter. It is not the study of ancient environments which will tell us about the change from foodgathering to food-producing way of life but the actual archaeological evidence obtained from the digging of ancient habitation sites. The former may help to explain as to why the change occurred, but before that we have to establish the fact of such a change.

As for the various areas of food-production contemplated by BRAIDWOOD, they are based on the evidence from Western Asia and are applicable to that region only. I am not aware if BRAIDWOOD anywhere suggests that similar areas are to be expected and looked for within the borders of every country or region. In fact, as far as the Old World is concerned, it is now almost universely admitted that the Neolithic economy first developed in Western Asia and then spread to other parts of the world. No archaeologist is looking for the evidence for transition from Mesolithic to Neolithic economy in, say, Lower Mesopotamia, Lower Egypt or Europe. They are instead trying to find the evidence for the diffusion of the Neolithic economy from the highland zone of Western Asia into these areas. A similar realisation on our part is also required.

To look for ' natural habitat zones of potentially domesticable plants and animals within our own borders ' will be a waste of time by running after a self-created mirage. Goat and sheep simply did not roam wild on the Deccan plateau and wheat and barley simply did not grow wild around Langhnaj or Navdatoli

or even Burzahom and Kuchai and no amount of palaeontological and palaeo-botanical research is going to prove otherwise. The arts of domestication and agriculture were already known in West Asia by the beginning of seventh millennium B. C. and those of pottery and metallurgy by the sixth and fifth millennium respectively. Thus a period of several millennia separates their development in Western Asia and the beginning of their diffusion into India. The need of the hour is to reconstruct the process of this diffusion by patient work in the field and the library. Some beginning in this direction has already been made by V. D. KRISHNASWAMI (1960) but it needs to be followed up by mature and competent archaeologists like THAPAR himself and his colleagues in the Archaeological Survey and others in the Universities.

D. P. Agrawal :

In my opinion the exclusion of the Chalcolithic culture of Central India and the Deccan from the purview of THAPAR's paper is perfectly justified. In his comments on this paper, Dr. MISRA has put up a case for the inclusion of these cultures under pure Neolithic economy, and has quoted CHILDE to explain away the presence of copper in these assemblages. If, therefore, we are lumping together all these cultures from circa 2300 B. C. (Pure Neolithic of Utnur) to circa 1000 B. C. or still later (Brahmagiri), that would mean taking a very static view of things. CHILDE essentially believed in a dialectical materialism under the influence of MARX, and always took a very dynamic view of human societies. If we perceive the gradual evolution of these economies, we can definitely determine the change which metal brought about. The general prosperity of these Chalcolithic cultures as compared to the pure Neolithic cultures of the Peninsula is undeniable. The evidence of growing specialization in the society is evident. The highly sophisticated pottery can now be made only by a specialist potter who depends for his sustenance on the surplus food produced by the society. There is evidence of spun cotton and silk, which again may point towards the people who were practising specialised craftsmanship in perishable materials. Whereas at Ahar we definitely know that metal was being smelted we have no definite knowledge about the Navdatoli celts.

We need not necessarily import the various stages of food production envisaged by BRAIDWOOD. In the Indian context, we can separate the three stages into · (i) pure Neolithic; (ii) Chalcolithic and (iii) iron age. This would mean that the advent of metal did mean a definite advancement of economy and reflected the presence of craftsmen. In Ahar we have clear evidence of copper smelting. Metal, first copper and then iron, is the hall-mark of the progress in these economies which led to the second urbanisation associated with the N. B. P. Ware. On chronological, technological, as also on economical grounds, it is obvious that the Chalcolithic cultures of Central and Western India do not belong to the pure Neolithic phase and hence should be treated separately.

A. Ghosh :

The implement termed as harvester in the Neolithic assemblage of Burzahom is also common in the Jomon Period in Japan as in the Neolithic periods of China and Korea. The associated objects, however, are different. The typological similarity of such a specialized tool anticipates cultural connection between the two regions (Kashmir and China, etc.).

Secondly the definition of the term Chalcolithic is illogical because it presupposes mixture of two elements. The occurrence of objects of copper or bronze would qualify the relevant culture as belonging to Copper or Bronze Age. Even if a single copper implement is used by a community, it must be treated as sufficient evidence to designate the culture as of Copper Age.

N. R. Banerjee :

THAPAR has given a dispassionate presentation of the Neolithic Problem in India. His conclusions regarding the divisions of the Neolithic cultures into zones are no doubt tentative and much work, viz. gathering and analysis of data relating to : (i) typology of the tools; (ii) their stratigraphical context; (iii) cultural wherewithals; (iv) material for dating; (v) comparing and correlating all this evidence in the intermediate areas as well as in the proposed zones still lies ahead. The incorporation of metal in the Neolithic economy should by itself form an interesting study. The study should also encompass the methods of the disposal of the dead besides those of cultivation of crops and irrigation including the dietary, and all other aspects of life as the evidence may indicate.

S. P. Gupta :

Two clear-cut and opposite views have been expressed on the question of terminology. The controversy has arisen because in his paper THAPAR has not included the so-called post-Harappan Chalcolithic cultures of the Deccan and Western India including Malwa within the Neolithic horizon whereas Dr. MISRA would like to classify these as Neolithic. To the latter, a term indicative of a culture should take into account ' the way of life ' or ' the economy ' of the people and not an industry; he makes a distinction between the ' village farming economy ' and ' urban trade economy ' and pleads that the former does not change into the latter just by the introduction of a few copper or bronze implements. This view does not take into consideration the introduction of a new trait of material culture that had all the potentiality of changing the ' way of life ' in the near future. It may be argued that at many sites the same pattern of economy continued even after the introduction of iron as for example during period II at Nagda. Will it be justified then in treating even these stages under the term Neolithic ?

Both the arguments are extremely sound in their own places, though not without difficulties. Unless worked out meticulously, as has been done by BRAIDWOOD in the Fertile Crescent, we shall never be able to differentiate the various stages of a change in ' the way of life ' and unless it is done, broad generalisations in regard to ' food gathering economy ', ' village economy ' and ' urban economy'

have very little sense in themselves. On the other hand, when we consider an industry as the criterian of differentiation, let us be really objective. In the present case the stone industry is certainly more dominant than that of copper and, therefore, no objective analysis of material can afford to ignore it. Since the term 'chalcolithic' indicates the presence of both the industries, it would be appropriate to apply it to such cultures where the knowledge of both stone and copper is attested to. However, I do agree both with THAPAR and with MISRA that in the ultimate analysis industries cannot be made the sole criteria of a term signifying a culture. If it were so, many of the Mesolithic cultures could be termed as Neolithic, e. g., grinding of stone tools was present in the Maglemosian culture and the blades with crested-guiding-ridge were available in the Natufian complex. Similarly some of the Upper Palaeolithic cultures could be included in the Mesolithic complex, for example Magadlenean III which had a definite microlithic element.

It is felt by DANI that for effecting a straight cut in the shouldered celts of south-east Asia a metallic wire was absolutely essential. Without disputing the contention let it not be forgotten that it could equally be produced by sharpened or toothed oval shells or even by agate blades if the raw-material is not very hard like basalt.

Some doubts have been raised regarding the Chinese association of the Burzahom Neolithic culture. To me these are not justified. As the shouldered celt is a fossil-type of the eastern Chinese culture, so are the perforated rectangular or crescentic harvestors of northern and central China. As the former infiltrated into southeast Asia and eastern India, so did the latter into Japan, Korea, etc., in the east and into the valley of Kashmir in the south-west. In fact, Burzahom seems to have assimilated within its own pattern a few traits from the Deccan and a few from China. The round-pointed butt type of polished axes with round cross-section, found by MOHAPATRA in the Kangra region and present in the Deccan, justifies my first contention. The crescentic butt type of polished axe with flat section and slight chamfered edge on the one side is paralleled in Chinese Turkestan at Lou Ean. Bone harpoons, points, needles, etc., seem to be local in character, necessitated by the presence of fish in various ponds that must have existed round Burzahom. Though bone harpoons, etc., are found in Manchuria and Lake Baikal areas, yet not only these regions are far removed from Kashmir but they also differ considerably in techno-typology. All this proves my second contention. Over and above this the pit-dwellings in the loessic deposits of Ordos, Central China, Yunan, and Burzahom have their ultimate origin in the Mesolithic Ordos Culture of northern China. It is plausible that the relationship between China and Kashmir was established through Gilgit and Sarhad and then along the foot-hills of the Kun Lun ranges, the same route as was chosen by people from the first century A. D. to the twelfth century. Sir Aurel STEIN's collections amply testify to it. Alternatively, there was another route along the river Khotan upto the middle Tarim. To me it appears that both the routes were followed. By this analysis, I do not mean to suggest a migra-

tion of people as such, unless of course the skeletal remains from Burzahom establish a definite Mongoloid population but to indicate possible routes of ' trait infiltration '.

K. T. M. Hegde :

THAPAR has rightly excluded the Chalcolithic cultures of the Deccan and central and western India from the purview of the Neolithic cultures.

It was the development of metallurgical technique that heralded the Chalcolithic era all over the ancient world. Though the Neolithic people were acquainted with the use of three metals–gold, silver and copper–they obviously were not in the know of extraction of these metals from their ores. Their use of these metals was restricted to the availability of naturally occurring, in other words, native metals. The metal objects of the Neolithic people, therefore, more often than not, consisted of tiny objects of personal adornment or small pins or fish hooks. From the shape of these objects, it could be said that these people were in the know of melting of metals, casting them and beating them to the desired shape. But they were not knowing smelting of the metal ores.

Melting metals is not metallurgy. Extraction of metals by smelting the ores is metallurgy. The metal objects associated with the Chalcolithic cultures of Deccan and central and western India, are made of extracted copper metal and some of them are of bronze. It is not difficult to distinguish the extracted copper from the native copper. The association of metal objects with a Neolithic culture will not alter the nature provided that, these metal objects are of native metals. When it is associated with extracted metal objects, it ceases to be Neolithic.

MISRA quoting CHILDE suggested that, the Chalcolithic cultures of the Deccan and central and western India should be included in the ' Neolithic ' as at these sites, excepting Ahar, metallurgical remains, such as ovens crucibles or slags were not observed. This suggestion cannot be accepted, as location of an ancient metallurgical site necessarily depended upon proximity of ore deposits and availability of fuel. Ahar was a Chalcolithic metallurgical centre, because it was close to the chalcopyrite ore deposits and was, as it is to-day, surrounded by forests. Presence of metallurgical remains in the form of slags at Ahar was, therefore, natural. The copper and bronze objects, recovered from the same stratigraphic levels as polished stone axes or microliths, however, few they may be, if made of extracted copper, positively indicate that these cultures have as much claim to be grouped as Chalcolithic as modern India to the Atomic Age.

These contacts are indicated in the studies carried out by me on the representative metal objects from Ahar, Prabhas-Patan, Chandoli and Navdatoli. Spectroscopic examination of the objects from these sites has shown that their metal was probably extracted from the copper ores of the Aravalli region. It is quite likely that the Chalcolithic settlements of the Banas valley were the primary metallurgical centres of the period. From these primary centres, metal was

carried to the other habitation centres by a metal working nomadic tribe like the Lohars of the present day Gujarat. At these habitation centres the metal was cast and further shaped by forgeing in accordance with the demand.

Gururaja Rao B. K. :

Sri A. Ghosh and Dr. B. B. Lal have expresssed the view that the occurrence of a single copper or bronze object is sufficient to classify a culture as Chalcolithic. In accepting this view we are faced with certain fundamental difficulties. If a certain artifact enters a community, the technology of which is not known to the natives, and which could not be used on a wide scale how can it change the economy or the mode of life of a community ? At Burzahom or at Sanganakallu or Brahmagiri, in those levels where the use of metal is attested, people continued to use stone tools for all their needs of daily life. By Chalcolithic, we mean an economy where stone tools and copper objects together determined the way of life of the community. In my view, therefore, until large-scale use of copper, accompanied by evidence for the knowledge of metallurgy is available, we should not hasten to label a culture Chalcolithic.

The other point relates to the objection taken by Misra to Thapar's contention about the indigenous origin of the Southern Neolithic Culture. Krishnaswami had a similar view in his mind when he put forward the above hypothesis. To my mind the indigenous origin mentioned by Thapar or Khishnaswami does not mean that the basic traits of food production of or grinding stone tools were invented in south India for a second time, independent of west Asian cultures It rather means that the format of the culture which, in time and space, is not connected with any other known Neolithic culture in the neighbouring region must have developed on the soil even though the fundamental traits or concepts might or even should, have been borrowed from the region where they were first invented. In that sense alone the southern Neolithic Culture is indigenous.

Lal B. B. :

I would feel that the presence of copper objects, irrespective of the quantity would mean the use of that metal which in turn may imply the knowledge of technology relating to the same. Where, therefore, metal objects are found in a stone using assemblage, the culture should more appropriately be classified as Chalcolithic.

Mohapatra G. C. :

In almost all recent literature dealing with the 'Neolithic' one finds too much stress on the economy which is gradually overshadowing the technical aspects of the culture. While reviewing the whole cultural evolution of man during the Stone Age (including the Neolithic), we find the coming of new techniques coupled with the changing environments responsible for bringing in a new adjustment which is interpreted as a new way of living or economy. To me 'Neolithic' represents basically a technical change which heralded many new

things unknown in the Palaeolithic and Mesolithic time. As a result, the old set-up or the economy underwent a change. So while discussing the basis of the Neolithic culture, one has to consider its basic innovations which brought such a massive change as to be termed 'the Neolithic Revolution.' As such it is really very difficult to agree with MISRA that 'it is the economy rather than technology which is the diagnostic trait of the Neolithic'.

The question of copper in the Neolithic is a matter to be considered in this perspective. We know that metal of any sort comes much later. There are many sites which show complete absence of metal in their earlier occupations. These pre-metal levels in the Near East provide evidences for the four great innovations of the Neolithic period i. e., the domestication of animals, pottery making, agriculture, and polishing and grinding of stone axes. In the strict sense this phase may be called the Neolithic. Only then we are justified in adopting CHILDE's three-fold division i. e., the Palaeolithic and Mesolithic Savagery leading to Neolithic Barbarism which ended with the Bronze Age Civilization. The last division or phase, like the Neolithic, came into being due to a great technical change which is interpreted as the beginning of the use of metal. A single stray metal object in the pure Neolithic strata should not lead us to conclude anything about the metallurgical activity of the period. Instead, it might help us in emphasizing the absence of the knowledge of metal working in that community which had to obtain it either by barter, exchange or gratis. The whole framework of prehistoric cultures will crumble down if only on the economic basis, metal is incorporated in the Neolithic and some of the microliths with pottery are included in the Mesolithic. Too much stress on economy, which at least in the case of India is nothing more than a drawing room speculation, will lead us to abandon divisions in prehistory like the Palaeolithic, Mesolithic, Neolithic, Copper Age and Bronze Age, etc., which are based on technical changes evidenced by convincing archaeological data.

With these facts in view we consider the early agricultural communities with knowledge of metal working (the Chalcolithic cultures) as another distinct stage not to be included within the Neolithic. Taking technology as the guiding factor in shaping the economy, the term 'Chalcolithic' very adequately expresses the salient features of the period i. e., incipient use of metal with stone artifacts (microliths and polished axes) plus a settled semi-urban life with agriculture and other necessary amenities. This stage, in fact, is a transitional phase between the Neolithic Barbarism and the Urbanization.

Precisely the first appearance of metal (not one or two pieces but evidence of metal working and its profuse use as in the case of many Chalcolithic cultures) should be given a distinct position if we are to interprete the evolution of cultures through various stages of technical progress. Otherwise, there is bound to be confusion and the Neolithic cultures of India will probably include a fair portion of our early historic period.

Here one may put a question; do we have a phase when metal is not known but the evidence of agriculture, pottery etc., is present ? The answer can be given

in the affirmative with certain reservations. The excavations at Kuchai and Sanganakallu have revealed a polished celt industry occurring over a microlithic (pre-pottery) horizon. Although we do not have too many excavated sites of this type still we expect a better answer from Chota Nagpur and Assam regions, the type areas of the Eastern Neolithic Culture.

The other point which may incidentally be brought out is that since long we have been including the shouldered celts within the Neolithic. Now, as we know, experiments have shown that abrasives and metal wires were perhaps used to saw out a perfect shoulder and faceted sides which are the most typical characters of these celts. Archaeological evidence has shown that these celts have so far been invariably found in metal age levels, of course in regions of India. Some have gone to the extent of suggesting that these celts are nothing but a stone copy of the shouldered celts. Hence the question of including them within the Neolithic tool types has got to be reconsidered.

Nagaraja Rao M. S. :

As against the absence of microliths in the Neolithic strata at T. Narsipur it may be mentioned that Hemige, a site recently excavated by the Mysore Department of Archaeology, testified to the use of microliths in the same economy. The latter site may, therefore, represent a late stage of the Neolithic cultures in the Peninsula. This is also borne out by the difference in the ceramic industries found at the two sites, as also by the time range of the Southern Neolithic Culture (circa 2000—650 B. C.)

Secondly, I would like to emphasize that the impact of a culture with advanced metal technology on another culture not using metal would accelerate the process of adoption of new traits. As such the presence of copper in any assemblage, even predominantly stone using, would place that assemblage under the Chalcolithic class.

S. R. Ṛao :

The term Neolithic should be used in the technological as well as economic sense. In the economic sense we may say that the Neolithic folk of Burzahom, Piklihal, Brahmagiri, Sanganakallu, Tekkalakota and T. Narsipur practised mixed farming although at some of the sites there is no direct evidence of food-production. The difficulty arises when the term is used in the technological sense, for, besides the polished stone axes, copper objects including celts and pins, reminiscent of the Chalcolithic cultures, have been found at the so-called Neolithic sites. Once it is admitted that copper or bronze was known to the stone-axe-using people, the term Neolithic is not applicable to them in the technological sense. It is immaterial whether they knew smelting copper or not. The very fact that they had come in contact with the higher copper-using communities entitles them to be classified as Chalcolithic folk. Even at Tekkalakota, which lies in a potential area, a copper celt has been found in the lowest levels. But there is a possibility of striking a pure Neolithic settlement unassociated with copper in the neighbourhood itself. Another potential area is the Shevaroy hills in Salem and North Arcot

Districts of Madras. Recently, the writer has discovered a Neolithic settlement at Bynapalli in Tirupattur Taluk where open air sites and rock-shelters with Neolithic assemblage have been located. But excavation alone will prove whether these people knew the use of metals or not. It has been pointed out that at Piklihal, Sanganakallu and Burzahom there are metal free zones of the Neolithic settlements, but the economy is not properly determined. What is necessary at the present stage is to explore the potential Neolithic areas of the Southern Deccan and to find out whether domesticable plants and animals existed here.

Sankalia H. D.

In the present context it is very difficult to separate the viewpoint of the archaeologist from that of the anthropologist. It is difficult to determine with a reasonable measure of certainty whether there is only one nuclear area for the beginning of food production or there are many such areas.

It is not known whether the axes found at Navdatoli are imports or an indigenous manufacture. A real Neolithic site showing a restricted or isolated use of copper evidenced by a single copper axe would not be classified under Copper Age. As against this Ahar assemblage is completely covered under Copper Age, as not a single lithic blade was found in association with it. If we postulate a metal-free Neolithic stage we must find out a site showing evolution of the level of economy and technology.

Soundra Rajan, K. V. :

It would be noted from the very cautious manner in which the entire evidence on Neolithic India has been marshalled by THAPAR that we do not indeed have any systematic evidence for the step-by-step evolution of the revolutionary changes in the social economy leading to the Neolithic. Indeed the extant evidence is suggestive of the fact that, purely on a technical plane, exception could even be taken to the term 'Neolithic' as used comprehensively in India for a particular stage. For example, we have evidence at Langhnaj on the one hand and at Burzahom on the other which by and large indicates a transitional period from food-gathering to food production, and if only from a purely socio-economic angle they would be unfit to be called 'Neolithic'. But, it is the familiar if limited facies of stone tools of a typical nature associated with the Neolithic, in the form of polished stone axes, wedges, chisels, adzes, hammers, ringstones, etc., that has given rise to the use of the word 'Neolithic' to any site which has yielded these. On the other hand, the terminology, so persuasively indicated by BRAIDWOOD regarding the early food-producing places in West Asia, and applicable for the rest of the world also in similar contexts, provides a too closely categorized sequence of stages and might not at least be used with facility for contexts as in India wherein the jump from the mere food hunting to food producing stage seems to have been effected in a few quick hops. We may, therefore, largely agree with THAHAR that in so far as the Neolithic in India is concerned, a lack of positive evidence for the actual cultivation of food cereals, as at Burzahom, is unfortunately glaring.

We may have to assess what is it that would, if at all, relate Burzahom Neolithic culture with the rest of the Indian sub-continent. It is seen further that a number of places have been recorded in the Punjab wherefrom Neolithic celts of the southern affiliation had been noted. Some of the more outstanding among these are those from Harappa, Attock, and the recently noticed one from Kangra valley in Tahsil Dehra Gopipur. This tends to emphasise the trend that in the second millennium B. C., there had been sporadic dispersal of the Deccan Neolithic into selective or receptive pockets of the extra Peninsula. The Burzahom culture does not seem to show clear proof of having any impacts of the Southern Neolithic, and it is also certainly not positively in any typical pastoral agricultural stage but rather in the transitional stage from hunting in the open to primitive agriculture. The nature of the devolution in Phase II from Phase I of the Neolithic occupation would further seem to give the impression that it rather merged from an organised hunting and food storing community given to animal husbandry to a more sedentary way of life, reflected in the introduction of wheel-thrown pottery, use of harvester tool (found only on the top of Phase II), copper tools, use of mud-bricks, terrestrial instead of subterranean habitat, enlargement of the stone and (bone) kit, and last but by no means the least the burial customs. This last practice, in its occurrence of extended as well as selected secondary burial accompanied by domestic animals, would seem to suggest parallelism with the Gujarat site at Langhnaj which is further supported by the evidence of trepanning noted in both places.

Thus we do seem to note that while the hunting-and-animal-husbandry food economy with a kind of 'subsistence' agriculture, where favourable, marked the cultures indicated by Burzahom and Langhnaj, the Deccan Neolithic in its earliest phases did show a prevailingly pastoral and functionally agricultural communities, comprising countless heads of cattle and a wide range of polished stone celts and allied implements. Metallurgy was unknown in the earliest stage and even in the subsequent phase when both painted pottery and copper metal craft impinge upon it from the central and western Indian zones in the second half of the second millennium B. C., it is only reluctantly assimilated and sparingly in circulation.

The use of microlithic artifacts, however, has definitely two phases in the Deccan and western India, the earlier, purely microlithic industries of the Late Stone Age in atavism, and the subsequent functionally unitary spell of blade producing, crested-guiding-ridge technique, an ancillary to the southward marching black painted red ceramic of central India and the inadequate metal resources. The absence of microliths as well as any painted pottery at Burzahom again mark it out as having been basically beyond the zone of the effective impact of the typically Indian early Neolithic stages and industries. In a way, the Burzahom Neolithic is but an organic extension of the semi-isolated character of the Kashmir valley upto the Potwar (Punjap) both in the Palaeolithic as well as the Neolithic linking it more adventitiously to the extra Indian tracts of central Asia, China, and the rest.

Reply : B. K. Thapar:

The comments concern chiefly about three major points : (i) definition of the term 'Neolithic'; (ii) metallurgy and its applicability in the Neolithic economy; and (iii) origin of the 'Neolithic' in India. On these points Dr. MISRA's comments are very stimulating indeed, if not convincing. As such I would amplify my views on each of these issues.

The concept of Neolithic pre-supposes a whole complex of traits which are admittedly difficult to define. It was the mid-nineteenth century savants like WORSAL and LUBBOCK who realized that THOMSEN's conception of Stone Age was used to cover various classes of tools, including the ground stone implements, and that there was a necessity for further sub-dividing his all—inclusive term into Palaeolithic for the crude primitive artifacts and Neolithic for the gound tools. The latter appeared as a stratigraphic zone identified by the presence of 'polished stone axes[2] overlying older chipped stone tools in Europe. The definition was thus purely a technological one, using an innovation in making of stone tools as an essential criterian for distinguishing the 'Neolithic.' Ever since then the concept has undergone a great change. Within a few years archaeologists argued for the inclusion of pottery and mixed economy of stock breeding and agriculture for the operational level of the definition of the Neolithic. As against this, the anthropologists wanted to emphasize the developmental stages in cultural evolution, rather than the simple temporal sequence. They recognized a stage between the food-gathering economy and civilization and termed it as 'Barbarism.' Attention was drawn increasingly to the desirability of finding out the origin of domestication of plants and cattle. In the early part of the present century BURKITT categorically listed the absence of metal in the Neolithic trait complex (ground stone tools, manufacture of pottery, domestication of plants and animals of western Europe. Later, Gordon CHIDE emphasized the functional economic significance of the event when he introduced the concept of 'Neolithic Revolution.' Still more recently, BRAIDWOOD developed a new terminology to replace the older typological terminology (Palaeolithic, Mesolithic and Neolithic) and the evolutionary terms of the culture-historians (Savagery and Barbarism) with such terms which lay stress on economy but also include settlement patterns. This concept is illustrative of the general growth of anthropological thinking in archaeology.

Coming to the diagnostic traits. It is now common knowledge that stone grinding technique developed earlier than pottery or even agriculture. Abrasive work is by no means an innovation of the Neolithic period, grinding and sharpening being in fact known in the Upper Palaeolithic times as well. It was the cumulative effect of more settled life or the need for a permanent settlement that systematic grinding for the wood-dressing tools like axes, adzes, chisels or for ploughing-hoes began in the early Neolithic. There is no evidence for the domestication of plants in the earlier stages of the Jomon Culture in Japan which is classified as Neolithic on the basis of effective settlement pattern revealed. In central Europe and southern Scandinavia, the Neolithic begins with the first food-producing culture which in some, but not in all cases, introduced pottery. In

Russia, Siberia, etc., the Neolithic begins with the first use of pottery by a people who in every other way had a hunting economy. Evidence of Jericho, Chatal Huyuk, Hacilar, Jarmo and a few other sites has clearly established the priority of food production and permanent settlements over pottery. Relative priority between agriculture and domestication of animals has not so far been settled with any measure of certainty. Domestication of animals itself would have passed through various stages such as : (i) loose contacts; (ii) taming in captivity; (iii) selective breeding; (iv) planned development of breeds and (v) gradual extermination of wild ancestors. Furthermore current research has even questioned the original motive for the domestication of cattle as to whether it was religious or purely economic. In the same fashion domestication of plants would show stages of development.

Recent studies have indicated that the examination of traces of wear could determine the exact function and help in reconstructing the details of past economic life. The wear straitions on the tools would show how the tool was used and on what material.

Against the background of this way of thinking or trend of research, we have to view the situation in India. Since the data in India is not sufficiently available or consistently documented either on the technological or on the economic level, it would be desirable if both aspects, viz. technology and economy are discreetly considered for defining the 'Neolithic.'

On the issue of metallurgy and its place in the level of economy, much has been said by the scholars present here. I would, however, plead that the occurrence of metal artifacts in an otherwise Neolithic assemblage would presuppose its diffusion by way of commercial relations if not by propagation of the technique of metallurgy. In the former case the apparent diffusion would show a constant acceleration through time from any point of origin, and is likely to create an effective and general demand for metal. This would certainly break the isolation of the purely Neolithic economy. It may be recalled that metal tools with their increased productivity of work afforded incomparable advantages over stone. One metal tool could in case of necessity replace several stone axes owing to the fact that its edge angle was considerably reduced and it could not wear out quickly. The occurrence of one metal tool implying the knowledge of higher technology or specialized craft would affect the way of life of the people to an appreciable extent. It would, however, be necessary to determine the degree of technological knowledge attested by the metal artifacts found in an otherwise Neolithic economy; there is a greater difference between hammering and casting than between copper and bronze.

As for the occurrence of copper at Brahmagiri, Piklihal, Tekkalakota, Burzahom, etc., it may be stated that at Burzahom there is already a metal free stratum designated as Phase I, and at Brahmagiri, Piklihal, Tekkalakota the presence of the metal artifacts should be viewed in a general sequence of the Southern Neolithic Culture which does present an evidence, howsoever meagre, of a metal free stage. Nuclear areas of metal free stages have still to be explored in

the region. Pandu-rajar-dhibi was not listed by me as a Neolithic site but was mentioned for deriving the probable chronology of the Eastern Neolithic Culture from one of the C-14 determination available for Phase III.

It may be recalled that in the Near East the appearance of bronze is preceded by a Chalcolithic or aneolithic copper using culture covering the eventful sequence of Halaf, Sammra, Ubaid, etc. In the present conceptualization of the term as outlined above, it would be difficult to agree with Gordon CHILDE's Contention for grouping these cultures under Neolithic. To escape such a situation, BRAIDWOOD had introduced a stage called 'urban settlement' for such communities.

About the origin of the Neolithic cultures, it may be affirmed that far from being a universal stage on either an evolutionary or diffusionist basis, the Indian Neolithic cultures are composed of different traits arriving in a different order in each of their regions of distribution. While the extrapolation of South Indian Neolithic Culture from the Near East through Baluchistan may afford a pleasing symmetry, it in no sense accounts for the environmental limitations to the diffusion of particular traits including plants or animals It is, however, well-known that traits do not always diffuse radially. Besides, the diffusion of Neolithic is not merely from village to village but in many instances could be by real migration. The conjunction of Neolithic traits is directly related to the geographical position of the area. Current research shows for example that domestication could, in theory occur at any time where man and the appropriate animals were in contact and as such there could be no single area for domestication. Within the last decade BRAIDWOOD's own nuclear area, earlier considered by him to be located in the Zagros has been considerably enlarged, and each centre does not seem to have borrowed substantially from the other. It may be that in many cases traits are inspired by stimulus diffusion but as ZEUNER feels the argument is more from lack of evidence than from supporting facts. He also admits that the Near East takes priority for the origins of such traits mainly by virtue of the amount of work done there.

About the Northern and Eastern Neolithic Cultures I have already indicated my line of thought which in general is shared and amplified by GHOSH and GUPTA. No antecedent stages of Burzahom Phase I have so far been identified within the Indian borders. The whole complex of traits represented by this culture is different from the other two Neolithic Cultures. In the present stage of research, however, it is difficult to state with any measure of certainty whether the round-pointed-butt axes in this assemblage are borrowed from the Deccan as GUPTA would like us to believe. Whereas it is universally accepted that the Eastern Neolithic Culture seems to have been inspired from the nuclear area of south-eastern Asia the Northern Neolithic Culture seems to be inspired or diffused from China, the question of independence or borrowing of the Neolithic traits of which is still open.

About the Langhnaj artifacts referred to by me as grinding-stones, I have nothing to add if this is the considered opinion of the excavator himself as expressed by MISRA. Both WHEELER and KRISHNASWAMI have called these objects as

grinding-stones. Since I had not seen these stone myself I had to depend upon such publications whose authenticity to my mind was undoubted. As regards the occurrence of pottery, it may be conceded that it is not an essential Neolithic trait, nevertheless its use implies, from the economic sense, a stage approaching primary settlement. That in itself is an important thing signifying a basic change and the beginning of experimentation . It need not surprise us if we have not been able to find ground stone artifacts at this stage. I have only hinted out possibilities for working out the transition from intensified-cum-terminal era of food collection through incipient cultivation and domestication of animals to the era of primary village efficiency. May be we do not have evidence for the last mentioned stage at Langhnaj itself but whether we can work out the first two stages is open for future research. In the present stage the relationship between Langhnaj and the other three Neolithic cultures of India is undefined. There is in fact no clear continuity between them.

Regarding the desirability of environmental data, while advocating its usefulness for reconstructing the economic life of the Neolithic times, I have never meant that this alone would answer all the questions. In fact it should supplement the other archaeological data.

Lastly, about the place of the shouldered celts in the concept of the Neolithic, I may state that we have still more definitive evidence to obtain (perhaps by laboratory examination of the striations in the sawn surface) about the sawing devices employed on these artifacts. Systematic sawing, an auxiliary state of working stone, was no doubt developed in Neolithic times and flint saws, emery plaques or sometimes even bamboo splinters and flat halves of bivalve molluses were employed for sawing grooves, but the employment of the latter techniques on the tools has to be attested in south-eastern Asia before the emergence of metal. It may be recalled that on our side we have still not been able to place our Eastern Neolithic Culture in a fixed time-scale.

NOTES

1. In the preparation of this paper I have received assistance from Sri N. C. Ghosh to whom my grateful thanks are due.

2. The use of the term polished as a synonym for ground tools is alike in exact and inappropriate inasmuch as polishing differs significantly from grinding. The former merely affects the surface and was never employed in the manufacture of tools, while the later involves removal of an appreciable part of the tool.

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THE INDUS CIVILIZATION : ITS ORIGINS, AUTHORS, EXTENT AND CHRONOLOGY[1]

A. GHOSH.

INTRODUCTORY

Ever since the discovery and identification of the Harappa culture in the early twenties and the dramatic pushing back of the beginning of civilization in the sub-continent that they involved, the questions of the origins of the culture and its end, its authorship and chronology, and allied issues have engaged the attention of archaeologists, and the desire to know its extent has prompted far-and-wide explorations. It must at once be said that no final conclusion has yet been reached in any direction; that itself may be one of the reasons that led the organizers of this Seminar to include the problems as a subject for discussion.

Within the last two decades not inconsiderable field-work bearing directly or indirectly upon the Harappa culture has been carried out both in India and Pakistan : in India mainly by the Archaeological Survey of India and the Department of Archaeology of Gujarat State, and in Pakistan by the Department of Archaeology of Pakistan and by ROSS, FAIRSERVIS, DALES, DE CARDI, and CASAL. Apart from reports on the field-work, excellent reviews of the Harappa culture, sometiemes acompanied with much orginal thinking, have been published; such works are by GORDON, CHILDE, MACKAY, MODE, PIGGOTT, SANKALIA, SUBBARAO and WHEELER. As my own contribution to the field is meagre, I have to draw extensively upon facts and views set forth by others.

THE ORIGINS AND AUTHORS

With no known beginnings the Harappa culture reveals itself to us in a fully-developed form. This itself lends to it a peculiarly romantic charm : while death from unidentified causes is understandable, natural birth is an unnatural phenomenon. The earlier speculations on its West-Asian origin have been discarded in view of its strongly individualistic features, though the inspiration for city-life from that direction (WHEELER, 1960, 17) has been thought likely.[2]

Nearer home, analogies have been traced between certain Harappan pottery-motifs and objects and those of the Kulli culture of southern Baluchistan (PIGGOTT, 1946, 15-16), and as the Kulli is generally believed to have had an earlier beginning, the Harappans, it has been thought, may have borrowed some ideas from it. In Sind itself, while at Amri the first excavator identified two distinct horizons respectively with the earlier Amri Ware and the later Harappan Ware (MAJUMDAR, 1934, 26-27) an overlap between the two was noticeable at Ghazi Shah and Pandi-Wahi (MAJUMDAR, 1934, 85 and 95), and the same story is repeated at Pai-jo-Kotiro in the Gaj valley (McCOWN, 1949, 14-16). These alleged Amri-Harappa contacts may have led to the following observation: 'The typical Harappan painted curvilinear pottery has tended to veil the origins of the design

elements. However, the presence of such elements as the pipal leaf, the willow leaf (especially in its multiple form), the overlapping scales, hatched triangle patterns, the antelope or ibex in panels and the Amri-Nal polychrome style suggests a rather close relationship between the Amri-Nal and the Harappan styles' (FAIRSERVIS, 1956, 355). A genetic relationship between the two groups of painted designs is thus hinted.

The existence of an alien pottery below the citadel-wall of Harappa, representing an occupation of the site by a 'preceding of lingering' people, has been known for some time, and a few such shreds have been compared with those from the Zhob Valley, particularly from Periano-Ghundai (WHEELER, 1947, 91-95) This fact has gained added significance within the last three years by the discovery of a pre-Harappan occupation at the Harappan site of Kalibangan in north Rajasthan, The excavation of the site is in progress under my colleagues, B. B. LAL and B. K. THAPAR, and some results are already available.

In one (KLB-I) of the two mounds at Kalibangan, occupation was noticed to have started earlier than the arrival of the mature Harappan elements at the site. The mud-brick houses of the period had an orientation different from those of the later period—the Harappa. The remains of the occupation were overlain by Harappan platforms, which are seemingly of a ritualistic character, but they have to be understood more thoroughly by excavation. In the other mound (KLB-2), occupation started with mud-brick Harappan houses regimented in a well-planned town in the right Harappan tradition.

THAPAR's broad analysis of the pottery-types and painted designs of the earlier Kalibangan occupation is under publication in the 1961-62 number of *Indian Archaeoloy—A Review*. Without much anticipating it, I may only state here that the pottery is generally light and thin in fabric (though sturdy fabric is by no means absent) and red-to-pinkish in colour and is painted in black, combined at times with white, over a slipless dull surface, mainly on the neck and shoulder. The designs are both geometrical and naturalistic. Vessels with rusticated lower parts, basins with designs obtusely incised or finely combed on the interior and vases with cord-impression on the exterior are other features. It is of great import to note that this pottery occurs in KLB-2 from the very bottom to about the mid-height of the mound alongside of the Harappan, after which it falls into disuse. Facts justify certain conclusions to wit :

(1) Kalibangan was first inhabited by a people who produced a pottery different from the mature Harappan, and who had no seals, terracotta 'cakes', and long chert blades characteristic of Harappa but used short blades of chalcedony and agate; (2) occasional deposits of sand and clay over their remains may indicate a flood may have been responsible for the abandonment of KLB-1; (3) the true Harappans with all their mature cultural equipment appeared on the site when the original inhabitants were still in its occupation; (4) they co-lived with the local population not only on the same site (KLB-2) but possibly in the same houses, for the two sets of pottery are found mixed up; and (5) in course of time the earlier elements fell into disuse.

In this context, I may be justified in recalling the results of my own 1950-53 exploration of the valleys of the dried-up-Sarasvati (Ghaggar) and its tributary, the Drishadvati, comprised in Ganganagar District in north Rajasthan, previously a part of the princely State of Bikaner. While I discovered a large number of Harappan sites, I also noticed on a few ones, particularly on the Drishadvati, non-Harappan pottery, which evidently antedated the Painted Grey Ware in the region. I was inclined to believe that this pottery was post-Harappan, but there was no excavation to corroborate or correct my belief, all the material having been derived from the surface. After one of the important Drishadvati sites I used the sobriquet 'Sothi' for the culture represented by this potttery (GHOSH, 1953), 'a little ambitiously perhaps' as WHEELER (1959, 124) says.

It is now known that the pre-Harappan pottery of Kalibangan is identical with the 'Sothi' pottery. And as the elements of this pottery have been isolated by excavation, it is easy to see that it is found mixed up with Harappan pottery on the surface of practically all the Sarasvati-Drishadvati sites; in fact, there is hardly any site, except perhaps a few Drishadvati ones, on which the one or the other occurs exclusively. In view of its importance I invite you to give a final name to this earlier pottery. I am, for obvious reasons, prejudiced in favour of 'Sothi', particularly as it has been referred to as such not only by WHEELER but by two other distinguished archaeologists as well (SUBBARAO, 1958, 100; SANKALIA, 1962, 197). The alternatives in the field may be: Sarasvati, Ghaggar, and Kalibangan I. Without prejudice to whatever name you may decide upon, I am retaining here the name 'Sothi' for the sake of convenience.

The Sothi Ware of Kalibangan is found to be analogous with the pre-defence (Periano-Ghundai) pottery of Harappa and also with that of the earlier (pre-Harappan) period of Kot-Diji (Khan, 1958) on the left bank of the Indus in Sind. At the latter place a burnt layer separates the pre-Harappan and Harappan materials. We are told that the former appears predominantly below this layer, which may mean that it continues in the Harappan layers as well; if so, the story of Kalibangan is repeated, at least partially. But on this important point the short published reports are not clear. (WHEELER, 1960, 16)

Owing to its wide distribution it is no longer possible to dismiss the culture as 'provincial' (WHEELER, 1960). Some of the designs occurring on its pottery are comparable with those on the Kili-Ghul-Mohammed Black-on-Red Slip Ware (radiating lines ending in solid disk), Kechi-Beg Black-on-Buff Ware (semi-circles in horizontals with the intervening areas cross-hatched), Quetta Ware (cross-hatched triangles, opposed triangles, double row of needles and fish), Jangal Coarse (radiating lines ending in solid disks) and Painted (scales) Ware and Sur-Jangal III (opposed triangles); analogies with Mahi-Nundara are also too considerable to be overlooked.[3] The rustication of the lower parts of vessels is closely allied to the surface-treatment of the Queeta Wet Ware and was no doubt produced by the same technique, though on the Quetta vessels the treatment is not confined to the lower parts (FAIRSERVIS, 1959, 269, fig. 59).[4]

At Mohenjo-daro itself, let it be recalled, the water-logged lowest levels have not been extensively excavated : what story they have to tell is futile to guess. WHEELER's (1960, 28) deep digging below the citadel in 1950 did not reveal any break in the cultural sequence; no non-Harappan material was encountered. On the other hand from MACKAY's (1938, 44 and 1937, pl. LXVII, 384) accounts we learn that the deep digging in DK Area in 1932, carried down to a depth of 27 ft. below the level of the present surrounding plains yielded incised pottery, the Quetta Wet Ware and a painted vase[5] which can at once be recognized as of the Sothi. GORDON (1958, 59), presumably on the basis of his personal observation, says that there were 'sherds of polychrome ware from —32 feet with a series of ovals having a vertical line down the centre of each, 'a motif so far found only in the bichrome Loralai III ware of Sur Jangal'[6]—perhaps pointing, like Harappa to a prior Zhob affiliation of the greatest Harappan site.

We turn back to the Sothi pottery. Some of its elements are continued in the mature Harappa. Of the painted designs, the fish-scale and pipal-leaf are common to both; so is the pottery with external ribbing, which occurs at Mohenjo-daro and Harappa (WHEELER, 1947, 118, fig. 24, 10 and VATS, 1940, II, Pl. LXXIV, 14), is frequent on the surface of most of the Sarasvati sites and is thus a probable Sothi feature, even though it is not found in the excavated early levels of Kalibangan. External cord-impression, a Sothi characteristic confirmed by Kalibangan excavation, occurs also on typical Harappan shapes at Mohenjo-daro (MACKAY, 1937, pl. LVIII, 5, 8, 9, 11, and 13; pl. LIX, 31 and LXXIV, 4). Basins with deep incisions or shallow combings on the interior, also a confirmed Sothi feature, are found in the Harappan levels of Rupar. The pre-citadel Harappan ring-stand (WHEELER, 1947, 92, figs. 8-9) is paralleled by finds at Mohenjo-daro even in the details of the obliquely cut rim and re-curved base (MARSHALL, 1931, III, 58, pl. LXXIXI) The short-stemmed dish-on-stand of the Sothi continues in the Harappa (MARSHALL, 1931, III, pl. LXXIX, 2.3). A terracotta cake of the lower levels of Kot-Diji (KHAN, 1958, 17), anticipates a typical Harappan artefact.

The occurrence of the Sothi Ware, comparable in some details not only with the Zhob (Periano-Ghundai) but with Quetta and central Baluch industries[7], in the lowest levels at Harappa and Mohenjo-daro, its abundance on practically all Harappan sites on the Sarasvati, the persistence of its traits in the Harappan pottery not only in the Sarasvati region but also at Mohenjo-daro and Harappa, the co-existence of the Sothi and the Harappan people at Kalibangan (KLB-2) and possibly also at Kot-Diji—all this cannot be dismissed as accidental but on the contrary must have a bearing on the Harappan genesis. A firm Sothi substratum is obvious in the make-up of the Harappa—much firmer than that of the other earlier cultures. There is every justification for regarding the Sothi as 'proto-Harappan'.

Even with all this, the problem of origin remains : who was the mature Harappan and where did he attain maturity? In spite of extensive work we have still to find the infant and adolescent Harappan. Perhaps we have to look for him within the culture itself and not outside it.

Let us visualize a set of people with a receptive mind, perhaps led by a few genius-dictators, bent on all-round improvement over existing conditions. Let us further assume that they borrowed the idea of cities from the contemporary Sumerians and established cities of their own with a superior planning, may be with the intention of outdoing the Sumerians. To gain prosperity they would promote trade with West Asia, and this would make them realize the need for standardization, which they would give effect to in all directions. Over the existing foundations in the rich river-plains would their ideas give rise to large cities controlled by an inflexible authoritarianism. Within a limited population and under strong leadership, all such changes, vast as they are, could easily take place within a generation or two. Such a set of ebullient people need not have been colonizers from outside, falling upon, overpowering, and destroying the local people: it might have been the local people themselves waking up to new ideas and working them out vigorously. And seeing the obvious advantages of the emerging order, their kindred far and near would soon align themselves to the new march of progress. Thus would be born a people with a new ethos.

Such a conception, if applied to the Harappa culture, would explain all the available data : the absence of its infancy, the existence of a single cultural substratum at so many centres of its existence in Sind, Punjab and Rajasthan and the peaceful continuation of that substratum at Kalibangan and perhaps elsewhere side by side with the more developed elements—there being no innate hostility between the two, for one was just the progression of the other. Perhaps again without extraneous influence, the Ganga Valley underwent a comparable urban revolution in the sixth century B. C., if with a feebler degree of standardization.

At the same time, the urban aspect of the Harappa culture need not obsess us too much. Of the vast number of known Harappan sites, only a handful can be given the status of a city. The overwhelming majority continued to be villages, wherein the people, though adopting new ideas and industries, must have basically continued the economy of the preceding peasant-communities and retained the older ceramic traditions in varying degrees.

What is said above is no doubt speculative, but it may be conceded that it has the merit of not conflicting with, I fancy even of co-ordinating, all known facts of Harappan origins. Such a highly artificial birth of the culture would preclude 'a slow and patient growths'[8]; it would also impart to it a rigid monotony which has been deplored by some (PIGGOTT, 1950, 201).

THE ANTHROPOLOGICAL DATA.

It is well-known that the analysis of the skeletal remains of Mohenjo-daro has revealed four racial types and has led to the conclusion that the population of the city was cosmopolitan (MARSHALL, 1931, I, 107-08; II, 638-44). In the absence of any material from a cemetery it is difficult to know which of the types, if any, represents the true Harappan.

In the field of somatological studies a welcome newcomer is the report on the skeletal remains of Harappa, many of which are from the Harappan cemetery R37[9]. The authors of the report have given us only the basic data, leaving a comparative study to be undertaken and inferences to be drawn by other specialists. For a layman like myself it is not possible to know, from the vast mass of statistical data, how the skeletons are to be racially affiliated. We are, however, told that round-headers are completely absent in R37 and that its population was more homogeneous than that of Cemetery H, to which we shall turn later on.

Very important is the conclusion that so far as cephalic index is concerned, the Harappan people of Mohenjo-daro have similarities with the present-day people of Sind, those of Harappa with the people of Punjab and those of Lothal with the people of Gujarat (SARKAR, 1964, 179). This, if true, is a complete blow to any idea of a homogeneous Harappan people : it can only mean that the Harappa culture was adopted by the local people at different centres; there should be no talk of Harappan colonization in any region of vast expanse of the culture. But as I cannot assess the basic data, I am not competent to have any views in the matter. Nor do I know which one of the three dolichocephalic types of Mohenjo-daro has been regarded as representing the true Harappan of that place.

EXTENT

The extent of the Harappa culture has been thoroughly dealt with by previous writers (WHEELER, 1960, 2–5), and there is not much further to be said about it. On the extreme west we have Sutkagen-dor on the Dasht, about 40 km. to the east of the Iranian border and 50 km. to the north of the Arabian Sea. Though WHEELER (1960, 48) regards the ceramic found here by Aurel STEIN (1931, 60-71) as 'provincial Harappan', DALES' (1962, 86-92) recent work has established three phases of real Harappan occupation, with a typically Harappan 'citadel and lower city' dichotomy of the settlement. DALES discovered a second Harappan site, Sotka-Koh on the Pasni estuary, about 130 km. to the east-south-east of Sutkagen-dor. He thinks it likely that the land separating Sutkagen-dor from the sea has accumulated out of natural forces within the last four thousand years, so that in Harappan times the town was right on the sea-shore. If so, both the settlements could be maritime traditing-stations of the Harappans.

The Quetta–Zhob valleys in northern Baluchistan are devoid of Harappan sites. The stray occurrence, recorded by FAIRSERVIS, (1956, 355) of two fragments of thumb-nail incised pottery and two perforated sherds at the Quettamiri site, a similarly incised bowl in a Damb-Sadaat III level and a sherd with a few Harappan letters at Site K_1 may only show occasional Harappan contacts. The Bolan Pass remained unguarded. But Dabarkot, at the foot-hills of northern-Baluch range, from its tremendous dimensions appears to have been an important Harappan station (STEIN, 1929, 55–64) reportedly overlying a thick deposit of pre-Harappan material,

Little need be said of the handful of sites in central Baluchistan, except that Mehi (STEIN, 1931, 154–65), well-known for its Kulli affiliation, has well-defined Harappa Ware, presumably over an earlier ware which has many Sothi designs. Kulli itself has a perforated jar (Stein, 1931, pl. XXV), but its other Harappan associations, if any, are obscure.

Interesting evidence of urbanization, probably under Harappan aegis, is available in the Edith-Shahr Complex of mounds in Las-Bela District of south-east Baluchistan, where in Complex A, with structures of a formal nature, was found Black-on-Buff and Black-on-Red painted pottery with Kulli designs, along with Harappan thumb-nail incised sherds and terracotta toy-carts and 'cakes', over an earlier, presumably Nal, deposit (FAIRSERVIS, 1961, 324–36).

There have not been many additions to the list of Harappan sites in the Sind part of West Pakistan after MAJUMDAR's work (MAJUMDAR, 1934; DEVA and McCOWN, 1949). Kot-Diji, on the left bank of the Indus, is an outstanding discovery. Another recent discovery is Judeiro-daro, (WHEELER, 1959, 89)[10], about 30 km. north of Jacobabad, separated from the Indus by a distance of about 100 km.

On the dry banks of the Hakra in Bahawalpur, the continuation of the Ghaggar in north Rajasthan, eleven Harappan sites were identified as a result of STEIN's exploration, though the actual number of such sites in the valley may be larger[11]. Further up the Sarasvati, in north Rajasthan, my own exploration brought to light about two dozen sites (GHOSH, 1952, 37–42; 1953; 31–34), the import of which has been discussed above.

The Jaisalmer and Jodhpur area, between the Indus Valley and the Aravallis is, at present, archaeological blank. The Harappans might not have crossed the Aravallis, which was to be the reserve of the Banas culture, the beginnings of that culture were probably not far removed temporarily from the later phase of the Harappa[12].

No discovery, of importance at any rate, has been recently reported from the Punjab part of West Pakistan. Harappa on the Ravi and Chak-Purbane-Syal on the Beas (VATS, 1940, I, 475–76) perhaps continue to be the only two known sites.

Further east, in the Indian Punjab, the most outstanding site is Rupar (*I. A. R.*, 1953-54, 6-7; 1954-55, 9; SHARMA, 1956, 121–29) near the priorly-known site of Kotla-Nihang-Khan (VATS, 1940, 475-76) in the Siwalik foot-hills on the Sutlej. While there can be no doubt that both belong to the mature Harappa culture, from their situation they may be taken to pertain to a late stage thereof (assuming, and there can be little doubt, that the movement was up the Sutlej from the direction of Sind); but *inter se* there may be some chronological variation, which has to be worked out.

Bara, not far from Rupar, has been thought to be a late Harappan site (*I. A. R.*, 1954–55) but remarkable is the presence there of a considerable number of painted Sothi motifs and (a profuse quantity of) incised ware. A similar

assemblage is noticed at Dher-Majra (PRUEFER, 1952; GHOSH, 1954, 38), where seeming Cemetrey H pottery also occurs. Harappan sherds are also reported from the surface of half-a-dozen other sites lying within a radius of 18 km. of Rupar and on the Sirsa, tributary of the Sutlej (*I. A. R.*, 1953–54, 38; 1955–56 59). Further west, the Sutlej-Beas doab, in Jullundur District, has two sites. A perforated jar, triangular terracotta 'cakes' and steatite disc-beads have been recorded from Raja-Sirkap near Faridkot in Bhatinda District, south of the Sutlej (*I. A. R.*, 1958–59, 73)[13].

It has been observed : 'Apparently the arrival of the Harappans on the Sutlej was a continuous process; they came in wave after wave, bringing new ideas and ceramic traditions' (*I. A. R.*, 1954–55, 9–10). In the absence of any knowledge of the main source of those ideas and traditions, it may as well be that they are local developments of a period when contacts with that source were becoming scarce. Furthermore, the profuse occurrence of Sothi motifs at Bara and Dher-Majra may indicate the need of fresh field-work and thinking. On the whole, our knowledge of the ramifications of the Punjab Harappa is in a nebulous state except at the well-defined sites of Rupar and Kotla-Nihang-Khan.

We are on surer grounds when we move eastwards to Alamgirpur on the Hindon, a feeder of the Yamuna, 50 km. to the north-east of Delhi, for the assemblage here is typically Harappan, of Rupar affiliation (*I. A. R.*, 1954–55, 50–55). Till now, Alamgirpur is the easternmost known centre of the true Harappa culture. From Alamgirpur to Sutkagen-dor a stretch of land 1550 km. in east-west length was covered by the Harappan stride.

The movement of the Harappans into Gujarat, probably motivated by trade, might have been somewhat later than the rise of the large cities in the north, but there is no reason to believe that it took place during an appreciably late stage of the culture. Lothal, the coastal town on the Gulf of Cambay, has all the elements of the mature Harappa[14]. The origin of the inland settlement of Rangpur (RAO, 1963) may have somewhat post-dated Lothal : RAO (1963, 19), the excavator, thinks that part of the Lothal population moved to Rangpur as a result of the devastating floods, no doubt, however, within the range of the mature Harappa itself. Excavation at Rangpur has established, in addition, a Late (or Degenerate) Harappa at the site, to be mentioned later on. Extensive exploration in Gujarat has shown the existence of a few other sites of the Harappa culture., the southernmost being Bhagatrav on the estuary of the Kim between the Narmada and the Tapti and a large number of Late Harappan and still later sites (RAO, 1963, 178–190). As, broadly speaking, the Harappan sites are located on the coast, a reasonable conclusion would be that the Harappans reached Gujarat by sea and were sometimes driven into the interior by circumstances or went there in search of merchandise. In addition to Rangpur, an inland site is Rojdi (*I. A. R.*, 1957–58, 18–20) in the heart of Kathiawar, the earliest occupation of which has unmistakable Harappan features, including a long chert blade and the Indus script on pottery, mixed with other elements, the identity of which remains to be established.

The painted Black-and-Red ware found in the Harappan levels of Lothal and Rangpur may be remotely connected with similar ware of the Banas culture. If so, this together with evidence of Rojdi, would indicate the existence of prior cultures in Gujarat at the time of the incoming of the Harappans.

The very recent excavation at Desalpur in Kutch by SOUNDARA RAJAN points to the same conclusion. While the details of the results are not yet available, according to preliminary information from Y. D. SHARMA, the Harappan association of the earliest occupation of the site is attested to by the dish-on-stand and perforated jar and a limited number of painted designs, and particularly by a lettered seal. All this is, however, mixed up with coarse plain red wares and a very typical thin grey or cream-slipped pottery, grey in core and painted all over with greenish-grey or orange-red wavy-line patterns doubtless of local origin. The next phase feebly continues the earlier ceramic tradition but is marked by the appearance of a cream-slipped bichrome ware. The affiliation of the local wares has to be determined.

The straight distance between Rupar and Bhagatrav, respectively the northernmost and southernmost Harappan stations, is 1100 KM.

CHRONOLOGY

It is only recently that a few absolute dates of the Harappa culture have been available by Carbon–14 determinations. Prior to that the direct and indirect evidences of its contacts with the western countries, particularly Iraq and Iran, were virtually the only available data for its chronology. Such evidences have been admirably set forth by WHEELER (1960, 90–100) and need not be repeated here. On their basis, the ' maximum opening-date ' of the culture has been put down to 2500 B. C.

The lower limit, I venture to feel, has been the victim of a somewhat subjective approach, and that has been encouraged by the absence of clear-cut data at this end. Thus, 1500 B. C., the ' Conventional Date ' (WHEELER, 1947, 81) of the first Aryan incursion into India, has also tended to become the conventional date of the end of the Harappans : the two events have been explicitly or by implication linked together.[15] It has also been hinted that the Gujarat Harappan might have lingered on till 1000 B. C.

Fortunately, the now-available Carbon–14 dates for the Harappa and allied cultures[16] are remarkably consistent within themselves and do not contradict any definite archaeological facts, so that there is little reason for doubting or discarding them.

For the two samples from Period I (pre-Harappan) of Kot-Diji, there are two dates : between (1) 2750 and 2460 B. C., and (2) 2490 and 2180 B. C. For a sample from the mid-level of the culture we have the range of between 2395 and 2115 B. C. The available date of a sample from a late level may not be reliable, as a mixture with later material is not ruled out. Keeping in view the Harappan dates (mentioned below), though they are not derived from Kot-Diji itself, the origin of the Early Kot Diji may be placed somewhere between 2700 and 2600 B. C.

Of the Harappa culture at Kalibangan the following dates are available.

(1) Lower Middle level : between (1) 2165 and 1955 B. C. and between 2135 and 1925 B. C.

(2) Middle level : between 2065 and 1855 B. C. and between 2035 and 1825 B. C.

(3) Late Level : between 2210 and 1980 B. C., between 2120 and 1970 B. C., and between 2005 and 1895 B. C.

The late levels of mature Harappa culture at Lothal have the dates ranging from between (1) 2120 and 1890 B. C., (2) 2120 and 1870 B. C., and (3) 2125 and 1895 B. C. The dates obtained for the late levels of Kalibangan and Lothal[17] are somewhat earlier than that for the same levels of Mohenjo-daro, for which we have the date of between 1975 and 1845, but the sample was excavated about four decades back.[18]

Though no date for any material from the early Harappan levels anywhere is available, the culture was certainly in its middle stage by 2100 B. C.; the archaeological date for its beginning, viz. 2500 B. C. is well-substantiated, though a half-a-century later date would still meet the requirements of the case. The Sothi can thus be easily equated with the Early Kot-Diji chronologically, as it is culturally.

More significant is the evidence for the end of the culture. At no station from which samples have been determined does the culture seem to have survived the 1800 B. C. mark; even a somewhat earlier date is not an impossibility. A margin of 1900 to 1700 would be fully justified, particularly as the Lothal Late Harappa Period (distinct from the late phase of the mature Harappa) is to be dated to between 1950 and 1670. The Lothal phase of the culture is also now established as a close contemporary of the northern phases; the surmises of its late origin and lingering on, for which even archaeological grounds, except *a priori* ones are lacking, have been proved to be baseless.

It has been stated above that the evidences for the alleged later contacts of the Harappans with the ouside world are not as solid as for the earlier ones, which stop with the Isin-Larsa epoch of Iraq. In view of the absolute dates now forthcoming, all such evidences need re-assessment.

IN THE SEQUEL

Foreign invasion, desiccation and spread of desert arising out of extensive deforestation, flood, rise in the underground water level and salinity affecting the fertility of the soil, water-logging in the Indus delta due to silt-deposition, natural decay–all of these factors have been individually or severally adduced as the cause of the end of the Harappa culture.

For no site with superimposed post-Harappan deposits can it be claimed that the newcomers there came into contact, friendly or hostile, with the Harappans. At Chanhu-daro Mackay's (1943, 24) excavation indicated desertion of the site after the Harappans. There has been much speculation on the identity

of the newcomers, but that does not concern us here.[19] At Harappa the evidence is that of a gap between the Harappan occupation and Cemetery H.[20] Likewise, Rupar, Alamgirpur and the Sarasvati sites (Ghosh, 1952 and 1953) presents no link between the Harappa and the later Painted Grey Ware cultures. Foreign invasions might have taken place in 'time of troubles', which witnessed large-scale tribal movements in Asia, but on no showing can any one of them be accused of killing the Harappans. The skeletons found in the top most levels of Mohenjo-daro and believed to represent a massacre by foreigners may not, it has been said, belong stratigraphically to the latest-known Harappan level of the site (Dales, 1962, 30-37; 1964, 36-43) —a statement which requires close checking up.

Of the natural causes, Dales (1964, 36-43), following the data worked out by Raikes and Dyson, would rule out the spread of desiccation and desert; according to him, there is no ground to uphold any hypothesis of an appreciable degree of climatic change in the Indus valley and Baluchistan during the last four thousand years. He is of the view that increasingly frequent and severe floods[21] which accelerated the silt-deposition at the mouth of the Indus, thus choking off Mohenjo-daro from the sea, and caused a rise in the water-table were the prime factors responsible for the desertion of the Indus Valley.

This may hold good for the Indus Valley proper, but elsewhere growing desiccation might have been a factor to reckon with. For example, in the Sarasvati region, while the Harappan sites, during the lifetime of which the river was no doubt alive, are located on the banks of the river, the settlements of the succeeding Painted Grey Ware people are sometimes situated right in the river bed, indicating that they appeared on the scene when the river had dried up, which would contribute to the spread of arid conditions. In Sind itself, while some of the sites on the Indus were re-occupied after the Harappan, none of those running parallel to the Khirthar range had a squatter population during post-Harappan times (Majumdar, 1934, 147). A development of unfavourable climatic conditions may thus be indicated.

An internal weakening of the Harappa culture is in evidence in the uppermost levels of Mohenjo-daro itself.[22] People were less prosperous, civic authority was weakening, trade was declining. It appears that the civilization had spent itself up. 'Decay is inherent in all component beings', said Buddha; in this case the decay might have been accelerated by some natural causes, the identity of which can only be inferred, for there is no direct evidence on it.

But this story is not repeated in all regions of the Harappan 'empire'. Rao (1963) has shown that at Rangpur and other sites in Gujarat the mature Harappa did not disappear but degenerated into an impoverished local culture.

The similarity of the anthropomorphic figures found in some of the Copper Hoards of the Ganga Valley with the one found in the Late Harappa levels of Lothal (J. E. Van Lohuizende Leeuw, 1960, 11-12; Sharma, 1961) rasies complicated problems for north India. At Bahadarabad (District Saharanpur) in the upper Ganga basin, which produced a hoard including such a figure, Y. D. Sharma[23] excavated pottery (almost definitely coeval with the hoard) which

comprised a tall-stemmed dish-on-stand, internally-incised ware, vessels with cord-impressions on the exterior-all Harappan features, together with a few shapes not represented in the Harappan. The pottery has the same fabric as what has come to be known as the Ochre-Coloured Pottery[24] identified by LAL (1951, 20-39) at a few other Copper Hoard sites and the lowest levels, preceding the Painted Grey Ware, at Hatinapura (Lal, 1955), and now found in the same horizon at Atranjikhera (District Etah)[25]; it has been collected from the surface at Manpur and Bhatpura (District Bullandshahar) (*I. A. R.*, 1960-61, 66) and has just now been excavated at Ambkheri (District Saharanpur) by M. N. DESHPANDE. Apart from a similarity of fabric, there are comparable shapes at some or all these sites, and a limited number of them seem to be traceable back to Rupar and Bara, but the presence of individual features is not to be ignored. A detailed treatment of the problem would be out of place here. It would suffice to say that the possibility has been raised that the Harappa culture survived in the upper Ganga Valley in a degenerate form (SHARMA, 1964)—as a jejune shadow of its ancestral glory. Driven from its homeland and deprived of its trade and prosperity, it perhaps led a straggled existence in some destitute tillers of the soil, waiting to lose its identity in the main stream of Indian culture. Perhaps the elders of the community would sing to the younger generation songs of the glory that had been Meluhha, Makkan or Dilmun, ballads of their adventurous forefathers who had braved the waves and carried a peacock as merchandise to the distant Baveru, where the natives admired the wonderful creature.[26] Perhaps they would relate to the youngsters how their ancestors had counteracted a sudden overflow of their river by ingeniously piling up almost overnight course upon course of mud-bricks to raise elevated platforms to live on; or perhaps they would woefully speak of an ill wind that had blown nobody good but had only brought in masses of sand to cover the river silt, the erstwhile rich bread-giver, turning it into an arid waste.

But while the possibility has been raised, it still remains firmly to establish that the people using the Ochre-Coloured Pottery who were perhaps also the authors of the Copper Hoards, were really the feeble descendants of the illustrious Harappans.

COMMENTS

M. A. DHAKY :

The genesis of the Indus Civilization has been postulated by GHOSH on a well-reasoned hypothesis to be an end-product of a synthesis on a basic Sothi Culture (regarded, for that matter, 'Proto-Harappan') with the earlier non-Harappan cultures. The latter elements played a role that was less dominant but none the less significant. Next, as against one genius conceiving, directing, and moulding the urban character and enforcing its discipline, a batch of genius-dictators are supposed to have accomplished the same task corporately. The catalytic inspiration of Sumer has been surmised to have worked in the conception of Indus town-planning. If, however, the beginnings of Indus Civilization are placed somewhere in the region of 2400 B. C. on the showing of

recent C-14 determinations, the theory of Sumerian influence–direct or implicit–has to countenance one objection. The direct contacts with Sumer, commercial mostly, could hardly have come into play before the crystallization of the Indus Civilization. The evidence from Sumer prior to that date is also in the negative. How the early progenators of Indus got this idea is a conundrum difficult to solve at the moment. The early creators perhaps carried further what their predecessors learnt through bits at several indigenous centres and what had at that moment accumulated to form a rich amalgam of experiences. The clues missing in accounting for the presence of several features may still lie buried in the Indus Valley itself. Sumer, perhaps, may not have blessed the beginnings of the Indus.

The surprising discovery that the cephalic index of Harappan skeletal remains in various regions conforms to that of the present day population in each region concerned, has been well argued to be indicative of the transmission of Harappa culture to the local people and not the colonization by the Harappans. This suggestion anticipates the existence of indigenous folk in each territory concerned : that these people possessed a quick and highly receptive mind : and they did not resist the cultural conversion. In the present state of our knowledge, evidence of Pre-Harappan local tribes outside the Indus Valley is scanty. In Gujarat, the near predecessors are known from Langhnaj; another slightly later indication is at Prabhas (Period I A). But then there are a number of disparate ceramic groups, which if representative of different racial and cultural groups, co-existed with the Harappans at a number of sites in Saurashtra. They persisted for a longer time without being swept away or assimilated by the Harappan at a number of sites in Saurashtra. They persisted longer and showed little inclination to change though Harappans did change some of their expressions eventually. The real Harappans, at least in some number, could have come as colonizers. And next perhaps, the environment of the new habitat began to alter their ethnic type conforming to the regional pattern.

The vast expanse coupled with fairly long duration of the civilization precludes the possibility of an absolute homogeneity in terms of space and time. On the available data, three major variations–the Indus Valley proper with its near proliferations, the East Punjab and the eastern Gangetic Valley, and Gujarat may now be recognized on the strength of certain individualistic features that are inherent, or developed in these regions. Not that the latter two facies are marked *toto coelo* from the Indus; no basic dissimilitude is implied but differences in mannerisms, preferences, and in certain cases independence of thinking distinguish them among each other. Silhouetted against the opulence of the classical Indus, the other two look less monumental, an assertion not meant to underestimate their contribution.

Recent explorations and excavations in Saurashtra and Kutch have altered the picture of the Harappa Culture within Gujarat. Almost all the important river valleys within Saurashtra once teemed with Harappan villages. Bhadar Valley sites such as Rojdi, Sultanpur, Dad, and Adkot, and Desalpur in Kutch are from among the earlier sites the foundations of which are contemporaneous with

Lothal A II-III and Rangpur IIA. At a slightly younger date, Prabhas and Una along the south-west coast, Ghelo Valley in Bhavnagar District, Aji Valley in Surendranagar District were occupied by the Harappans. This was the time when Period II B prevailed at Rangpur and A IV at Lothal. Finally, the sites at Belora, Wegadi, Bhamakdad Dumiani and a large number in Jamanagar District including the excavated ones at Wasai, Lakhabaval and Amra were established when at Rangpur Period II C and at Lothal Period B (V) prevailed. The successive stages of the Harappan expansion within Saurashtra are now clear. None of the Harappan settlements was established as a sequel to the Grand Deluge of 1500 B. C. After their first settlements the movement within Saurashtra seems to be a case purely of internal dispersal as indicated very strongly by ceramic evidences.

Recent radiocarbon dates have helped to define the beginnings as well as the end of Harappa Culture in general. The former generous datings are now modified; Lothal now seems to range between 2250–1750 B. C. Similarly the relative positions of the important excavated sites in Gujarat will have to be revised also. Comparing Prabhas vis-a-vis Rangpur, its I B remains equated with the upper half of Rangpur II A on account of the presence of carinated dishes with expanding rim and convex sided bowls in Harappa Ware, a lenticular sard-onyx bead and a hoard of 10,000 microbeads of steatite similar to 4,900 of Rangpur from its Period II A. Lothal and Prabhas when compared admit of a new equation. The same micro-beads occur in Period III at Lothal. The 'Reserve Slipped Ware' found at Prabhas is paralleled at Lothal in Period A II and A III. The typical Prabhas Ware found in the redeposited debris at Lothal is now presumed to belong to at least Period A IV. All points considered, Prabhas I B seems to be coeval with Lothal III B. The Prabhas Ware and a few sherds of the typical Harappa Ware of Prabhas occur at Rojdi in the middle levels of Period I B there. The comparison of Rodji vis-a-vis Lothal is equally interesting. The Harappa Ware of Rojdi in Period A I does not materially differ from that of Lothal I A-II and Rangpur II A. And despite differences in idioms and nuances, the Harappa Ware of Rojdi I B resembles that of Lothal AIII. The Pink Ware (Micaceous Red Ware) which is confined to Lothal A, is also available at Rojdi in Period II A and B (upto middle levels). From the lower level of Rojdi I B two hoards, one of about 10,000 and the other approximately of 45,000 microbeads of steatite have been recovered. The mineral beads of Rojdi I B (lower levels) are very similar to those found in Lothal AIII and Rangpur IIA; the typical etched carnelian beads of Lothal AIII and Rojdi (lower levels of IB) indicate a strong synchronism between the two. The copper objects, more numerous and varied at Rojdi than at Rangpur, tell the same story. The cubical chert and agate weights from the lower and middle levels of Rojdi IB are paralleled in Rangpur IIA and Lothal III. The final verdict is delivered by the recent C-14 determination which is 3920$\pm$ 115 (new value) for the middle levels of Rojdi IB; it is closely comparable to those known from Lothal AIIIb.

When the lamp of the Indus Civilization extinguished in the Indus Valley due to a combination of various causes it continued to burn in Gujarat for some centuries further. A Neo-Harappan Culture developed as witnessed at Rangpur in Period IIC and III. The new ceramic–the Lustrous Red ware is also known at Prabhas in its Period II. Its last stage is not represented at Rangpur but at Prabhas (II C). It is decadent in every sense of the word. The culture was on its death bed. Its range in time scale seems on reasonable grounds to be 1700–1400 B. C.

M. N. Deshpande :

I would take this opportunity to acquaint the scholars with the results of some chance discoveries made by my colleagues and myself in the North-Western Circle, in the districts of Jullunder and Ludhiana in the Punjab, and some planned exploration in the Sahranpur District of Uttar Pradesh and discuss their bearing on our knowledge of the Harappa Culture.

As a result of these explorations, two Harappan sites were noticed at Mudiala Kalan in District Ludhiana, and Katu Palon in District Jullunder. The painted pottery from Mudiala Kalan is a thick sturdy ware with the usual decoration of black horizontal bands on red as also cross-hatched triangles between two rows of horizontal bands with the intermediate space filled with circles having a set of short radiating lines above and below the circles. Some painted sherds also have rusticated surface with raised horizontal bands below the painted surface. It has besides a large variety of incised decoration on vessels with the lower parts covered with a coarse paste of clay. The pottery has, in this respect, general affinities with the Bara pottery. Katu Palon pottery also shows a large variety of incised decoration usually on the shoulder portion of the vessels, the portion immediately below the decorated surface being rusticated in the same manner as on the Madiala Kalan pottery. The incised decoration consists of a series of horizontal lines over which oblique lines are drawn in singles, or in sets of two, three, four or five, dividing the whole surface into compartments. Wavy lines drawn by a comb-like instrument also occur but infrequently. Deeply cut incised chevron pattern is also met with in a few cases. It may, however, be noted that all these incised decorations are restricted to the outer part of the pot and not to the interior as at Kalibangan I or Sothi. The deeply cut, oblique incised lines on the interior of the basins at Kalibangan were probably motivated by a utilitarian purpose while the interior decoration described above in respect of pottery from the Punjab sites was purely decorative in character and in this respect conforms to the late Harappan complex found at Bara, near Rupar in the Punjab.

Further south, limited but systematic explorations in Saharanpur District have brought to light Harappan sites at Pilkhani and Bargaon, both in Nakur tahsil. A very limited excavation of the mound at Bargaon on the banks of Maskara, a tributary of Yamuna, has brought to light varieties of interesting antiquities. Among other things, a copper ring of the type reported from Pondi, Bahadarabad and Jorwe has also been found here. The occurrence of the copper ring in a

typical Harappan assemblage, calls for fresh thinking as regards the relationship of the Harappan with the so-called O. C. P. In this connection, it may be pointed out that the excavator of Bhadarabad, Y. D. SHARMA, feels with reasonable certainty that the O.C.P. of Bahadarabad and the copper implements found in a hoard at that place go together. At Bargaon was also found, unslipped Ochre-coloured ware as well as the illfired slipped ware. This latter ware is like the O. C. P. where the slip usually gets separated from the surface as soon as the sherd is washed or handled in order to remove the clay sticking to the surface. Typically Harappan pottery with black painted designs on red surface was also found in the excavation. Among other finds, mention may be made of a chert blade, a variety of terracotta cakes, a bone point, terracotta wheel of a toy cart with the central hub, stone weight, terracotta and faience bangle pieces, the last named having oblique incised decoration. The terracotta cakes from Bargaon are generally oval in shape with a few longish ones with tapering ends, but all implying their manufacture by hand, unlike the triangular ones which were produced out of a mould. The Kalibangan cakes of period II appear to be the parent type, after which the local varieties were modelled.

Coming to pottery once more, in order to study the decorative motifs and types, we find the presence of sherds with cord-impressions like Bahadarabad. Pottery with rusticated surface and with raised bands is also found here. Incised decoration on a ring stone depicting chevron pattern shows remote inspiration from Kalibangan I, though the decoration is limited to the outer surface. Dish-on-stand and the Indus goblet are common types. Some pottery shapes and paintings suggest Cemetery 'H' influence. A detailed study of pottery finds would help in isolating different elements of the culture complex, but as a result of general assessment, it was noticed that the upper layers show a greater variety of paintings including cross-hatched triangles set within horizontal bands, wavy lines etc. while the lower levels contain simpler designs of horizontal bands only which are restricted to the portion below the neck, shoulder and belly. The upper levels may have Cemetery H influence. There is a total absence of perforated pots both from the surface and excavation.

Coming to the results of a small-scale excavation at Ambkheri in District Saharanpur, it may be stated that the site yielded pottery which can at once be described as ochre coloured. It is usually bereft of any slips and whatever slip it may have had is separated from the base with the removal of that clay. Sherds with the slip intact do not, however, show traces of painting. The pottery can at best be described as ill-fired. Curiously enough the site has not yielded any incised pottery of the type found at Atranjikhera on the one hand or like the other sites in the neighbouring areas of Saharanpur or the Punjab on the other. The presence of a fine *de-luxe* flask, oval in shape and with a base, again suggests that Cemetery H culture may have influenced its production. As regards the shapes, the dish-on-stand with short stem, bowl-like lids with central knob, basins with hooked rims, miniature cups and pots, the Bara type of vases with a flanged rim are met with. Pottery with cord impressions and external ribbing is also present. Terracotta figurines including a fragmentary humped

bull with a long head and the presence of terracotta cakes clearly suggest Harappan ancestry. No copper object was found in the excavation.

Hand-made bricks of different sizes were employed in the construction of a hearth, but the use of bricks for constructional purposes was not met with. Remains of a brick-kiln were noticed in one part of the site, but the remnants of bricks suggested that they were fashioned by hand and did not conform to a set size.

From the foregiong details, it will be seen that it is a degenerate Harappan site while Bargaon may be described as late Harappan.

Another interesting fact worth noticing is the presence of a dull-red ware bearing relief decoration–wavy or ripple–which is met with the P. G. W. culture as an associated type. It is this ware which continues in the subsequent period and thereby provides an important clue for the make-up of the P. G. W. culture. If the P. G. W. is an outside imposition, the dull-red ware is an indigenous element contributed by a people whose earlier traditions had degenerated and who had lost the vigour of their forefathers. This also helps in postulaing a very late period for the culture complex met with at Ambkheri.

S. R. Rao :

Ghosh is inclined to regard the Sothi culture as proto-Harappan in view of the strong Sothi sub-stratum noticed in the make-up of the Harappa culture at Kalibangan and Kot-diji. The Sothi ware, he says, occurs in the pre-Harappan levels at Kalibangan, Kot-Diji, Harappa, Mohenjo-daro and several other sites in the Indus and Sarasvati valleys and bears close resemblance to the Zhob (Periano-Ghundai), Quetta and Central Baluch industries. Although it has a wider distribution than any other pre-Harappa ware known so far, its non-occurrence in Gujarat is not without significance. Different indigenous culture groups appear to have occupied the coastal belt of Gujarat before the advent of the Harappans on the scene. The occurrence of the Micaceous Red Ware and painted Black-and-Red Ware in the lowest levels at Lothal along with the characteristic Harappa wares clearly suggests that Gujarat was not a cultural vacuum in pre-Harappan times (Rao, 1963, 178-179). On the other hand the Micaceous Red Ware people had already developed the bowl with a stud-handle and painted their vessels with a very fine brush. The designs included curvilinear patterns, zigzags, vegetable motifs and hatched diamonds, the main ceramic forms being bowls, and jars with flaring rim. They also used a coarse grey ware decorated with incised patterns. They had protected their settlement from floods with a mud-bund and the ships were moored along the quay.

It is true that a purely pre-Harappan level is not yet reached at Lothal, but it is obvious that the Micaceous Red Ware folk had lived here for a considerable length of time before the Harappans arrived, as can be inferred from the 10 ft. thick occupation debris, wherein large quantities of the Micaceous Red Ware and a sprinkling of the Harappa Ware are encountered below the water table near the pottery yard.

The Harappans borrowed the ceramic traditions of the Micaceous Red Ware people at Lothal, which explains the occurrence of the bowls with or without handle in the Harappa fabric also. The Black-and-Red Ware and the coarse grey ware came to be used by the Harappans resulting in a blending of the two cultures.

At Prabhas, too, the earliest culture is not the Harappan but an indigenous one using a grey ware besides short blades of chalcedony. Further north at Desalpur (Kutch), a thin grey ware, a cream-slipped ware and a coarse red ware are associated with the Harappa wares in the earliest levels. Hence it may be presumed that the Harappa culture borrowed certain elements of the indigenous cultures in Gujarat just as it did substantially from the Sothi culture in Rajasthan. If this is accepted, it is easy to explain the peaceful continuance of the local sub-stratum in the Harappa culture at Kalibangan, Mohenjo-daro, Lothal, Desalpur and perhaps, several other centres.

Excepting Lothal, no other Harappa settlement in Gujarat can be said to have been urbanized. There were several rural settlements around Lothal. Rangpur and Koth are two such settlements of the mature phase, and nearly fifty small settlements of the late phase have been plotted. The process of urbanization can be traced if an extensive area of the earliest levels of Lothal is excavated. Hence one need not be obsessed by urbanization nor is it necessary to presume that it took place within a very short period. The so-called 'dead uniformity' is made much of. In fact, at Lothal itself we have two standards of weights and more than three sizes of bricks. The widths of the streets and the sizes of the houses varied greatly.

There are certain other aspects of the Harappa culture such as religious beliefs and social customs which varied considerably from region to region. For example, while the Mother Goddess was very popular in the Indus Valley it seems to have been practically unknown in Gujarat. Similarly, the fire-cult which was very popular at Lothal, and perhaps at Kalibangan too, does not appear to have been known in the Indus Valley proper. Animal sacrifice and joint-burials practised by the Lothal folk are unheard of in the Indus Valley. Thses regional differences developed as a result of the combination of various cultural streams. It is not possible to say whether they indicate the existence of separate ethnic strains in Gujarat and the Indus Valley. But the reports of the anthropologists on the skeletal remains from Harappa and Lothal clearly say that the population of Harappa was similar to the present-day population of Sind while that of Lothal bore close resemblance to the present-day population of Gujarat. Ghosh has pointed out that these observations are contrary to the general belief that the Harappans represented a distinct ethnic strain. What is more interesting is that the ratio of the Armenoid and Mediterranean groups in the Lothal population is in the ratio of 3 : 4. The Australoisd type is represented by one skull.

In deciding who the authors of the Indus Civilization were, we have to take into consideration certain new evidences obtained from the recent excavations,

It is now firmly established that the horse and rice were known to the Harappans in Gujarat in the mature phase. They worshipped the fire and sacrificed animals. Based on this evidence, a section of the Lothal population may be identified with a cultural group having affinities with those who spoke the Aryan language and followed the religious practices and social customs of the Aryans.

In discussing the chronology of the Indus Civilization GHOSH has pleaded for a shorter chronology. The beginning of Lothal should go back to 2400 B. C., if not earlier in view of the fact that the penultimate phase of the mature Harappa culture (Phase III B) at Lothal is dated 2,000 B. C. by the Carbon-14 method. There are five structural sub-phases (I, II A, B and C, III A) below IIIB. Furthermore, the Reserved Slip Ware which occurs in the Sargonid levels at Brak and the Early Dynsatic Period in the Diyala Region and Ur, is found at Lothal in Phases II and III. The Persian Gulf Seal from Lothal is also suggestive of contacts with Bahrain in the Sargonid period. Hence, the beginnings of Lothal may be dated 2400 B. C. if not earlier. In this connection it is necessary to point out that D. P. AGRAWAL has taken into account only the Carbon-14 dates, all of which relate to phases IIIB, IV and V, and has not taken the earlier levels into consideration at all. Secondly, the mature Harappa culture ended at Lothal with phase IV which is dated 1900 B. C. A clear distinction should have been made by AGRAWAL between the mature and degenerate phases of the Harappa culture. The former extended from 2450 to 1900 B. C. and the latter from 1900 to 1600 B. C.

The transmutation of the Harappa culture into the Lustrous Red Ware culture is evident at Rangpur.

The eastward movement of the Harappans from the Indus into the Ganga Valley seems to have taken place under circumstances not different from those which forced the Harappans in Kathiawar to move from the coastal region to the interior. Deprived of their prosperity, the Harappans wandered in Gujarat and the Ganga Valley until they lost their identity. There is evidence in the form of flood-debris, baked-brick revetments of mud-brick platforms etc., at the Indus cities, which reveals hurried constructions and mending of breaches caused by devastating floods. It is also wondered whether the peripheral walls of the cities would have been defences against invaders. On the other hand, they seem to be anti-diluvian measures taken by the inhabitants. This is abundantly clear at Lothal.

Y. D. Sharma :

GHOSH believes that the origins of the Harappa culture or Indus Civilization may perhaps be looked for within the culture itself and not outside it. In general, I believe that is as good a thesis as one can offer in the present state of our knowledge. But the statement can brook some qualifications. I do not mean that I am going to furnish a more adequate or satisfactory explanation of the origin of the Harappan culture. All I intend to do is to draw the attention of scholars to certain points which may be borne in mind while considering this question,

Although STUART PIGGOTT (1946, 8–26) has worked out a sequence of certain pre-Harappan cultures in Sind and Baluchistan, his sequence is by no means final. In any case, some of these cultures overlap with each other. The same would be true also of the Sothi culture. It co-existed or overlapped with some of these Sind and Baluchistan cultures. Sothi, therefore, may be regarded as 'Proto Harappan' in the sense that the Sothi culture or certain of its elements were absorbed by Harappa culture. They went into its make-up. But there were also other elements, such as Amri, Nal, Zhob, Kulli and Kot-Diji which apparently participated in varying degrees in giving something of their own to the Harappa culture.

The fact that certain Sothi elements occur also in Amri, Zhob, Quetta, Sur Jangal, Mehi-Nundara cultures etc., does not necessarily indicate that these elements have found their way into these cultures from the Sothi culture. The common occurrence of these elements arises either out of mutual borrowing or borrowing from a third parent source. I feel, therefore, that till we have a quantitative and qualitative analysis of those Harappan elements which are distinctively or solely Sothi and till they can be shown to preponderate over other Harappan elements which may be found in Amri, Zhob, Kulli cultures etc., Sothi may be regarded as only one of the cultures which went into the making of the Harappa culture. It is one of the partners and perhaps not a major partner either. Also, its influence is to be seen more in Rajasthan, Punjab and Uttar Pradesh than at the parent sites of Harappa and Monenjo-daro.

I am also not quite certain if we would be justified in equating Sothi and Kot-Diji cultures, or even in looking upon one as a variant of the other. They have certain common characteristics in pottery. But the stone defences, stone foundations of mud brick structures, leaf-shaped chert arrow-heads and occurrence of terracotta 'cakes' are features not encountered so far in the Sothi culture.

It is quite conceivable that among several co-existing pre-Harappan folks, one took the lead, and with the alignment of other kindred folks developed the integrated group into the 'Harappan people' with their distinct culture. But the set of people which took a lead were not perhaps the Sothians or the Kot-Dijians. For even in pottery, although some of the Sothi or Kot-Diji designs occur on Harappan pottery, the general run of the latter is sturdy and thick, as opposed to the thin sections of Sothi and Kot-Diji wares. I feel that a people might borrow the motifs of paintings on pottery from another folk, but not perhaps its thinness or thickness. We should, therefore, perhaps look for a people with thick and sturdy pottery who would, as a result of integration, form the core of the Harappan people.

There are again other cultural elements to be considered. Script is one of them. Transmission of a script from one folk or region to another is known, but we are as yet nowhere within sight or even suggestion of the source from which the Harappans borrowed or developed their script.

H. SARKAR of the Archaeological Survey has drawn my attention to the recent book by S. S. SARKAR (1964) in which the author has worked out the racial affinities of the Harappan people on the basis of the skeletons examined by the Anthropological Survey. Broadly speaking, his conclusions are that the R 37 and Cemetery H Stratum II people, with a cranial index of 71 are Indo-Aryan or Indo-Caspian, as the 'people of Tepe Hisar I and II, as also the present-day Chuhras and Sikhs of the Punjab.' But Cemetery H Stratum I and Area G people of Harappa are mesocephals with a weak strain of brachycephaly as in Tepe Hissar III. The population of Indus cities was, however, no doubt mixed, as an Australoid strain appears also to be represented.

Even with this new analysis, let it be admitted, we are not in a position to work out the racial affinity of the bulk of the Indus Valley population, since the practice of cremation, as apparent from jar-burials, was also probably in vogue. Post-cremation burials also obtained in Zhob, Kulli, Mehi and perhaps in other pre-Harappan cultures.

Coming to the extent of the Harappa civilization I do not aim to name all such Harappan sites as are not mentioned in GHOSH's paper. But the following may perhaps be added :

(i) Deheru, Manupur and Kheri-Nudh-Signh along the course of Budhanala, a dried-up bed of Sutlej near Ludhiana. (*I. A. R.*, 1961-62, p. VI-15). These sites are lower down the Sutlej from Rupar, and may ultimately help us to map out the route by which the Harappans reached Rupar.

(ii) Two other sites, Badhauli and Dukheri are reported to have been recently discovered by the Punjab University. They lie in district Ambala on a nullah called Tangri, which joins the Markanda, which in turn falls into the Ghaggar. This again is a discovery of some importance. No Harappan sites were known earlier from this region. If the Harappans reached here directly over the Ghaggar, the earlier assumption made by me regarding the route Harappans took in coming east would need some modification. It would appear that they bifurcated somewhere in Rajasthan, one lot keeping along the Ghaggar itself while the other may have reached the Sutlej over a stream, now dried-up possibly the Naiwala (SHARMA, 1964,7).

I had identified three distinct phases of the Harappa culture on the upper Sutlej, (*I. A. R.*, 1954-55; SHARMA, 1964, 8) : Kotla-Nihang-Khan as the earliest, Rupar coming next and Bara last. In view of the discovery of a pre-Harappan culture at Kalibangan, which possesses some painted designs with a 'family likeness' to those at Bara, fresh fieldwork is called for, particularly with a view to obtaining Carbon-14 dates for these sites.

Alamgirpur, is, no doubt, the easternmost excavated site of Harappa culture in the Ganga-Yamuna Doab but there need be no doubt about the Harappan affiliation of Manupur on the Kali Nadi and of Bhatpura further east, between the Kali Nadi and the Ganga. I have also no doubt that the site of Ambkheri, recently excavated by M. N. DESHPANDE, is also Harappan, although it has yielded only poor and degenerate specimens of pottery.

Harappa culture may have reached Gujarat over the sea. But one cannot be too sure of it, particularly because Desalpar in Kutch shows clear Harappan traits. We also know that although the Rann of Kutch may not provide a passage all through the year, it can be crossed by small groups during some months of the year. To my mind Desalpur shows affinity with Sutkagen-Dor not far from the coast of the Arabian Sea, with which it shares a stone-built city wall and structures. In the present state of our knowledge, we also do not know if the thin grey or cream-slipped pottery with greenish-grey or orange-red wavy line patterns is local or came with the Harappans whose caravans other people using this pottery may have joined during their migration from Sind. The Black-and-Red ware of Lothal and Rangpur would, however, seem to be localy manufactured by people already living in Saurashtra before the arrival of the Harappans.

Com ing to chronology and sequel in the first instance, let me correct some minor inaccuracies in the main paper, although these do not affect the argument in any way. The Copper Hoard from Bahadarabad included typical objects like a hooked spearhead and shouldered celt, but no anthropomorphic figure. The dish-on-stand from there is short-stemmed, not tall-stemmed, and a few of the pots are incised, externally, not internally.

I have already stated above that both Manupur and Bhatpura are Harappan. The Harappan affinity of Bahadarabad is not so firm, although this site has a dish-on-stand. The affiliation of Atranjikhera is not at all clear at the moment. The fabric, texture and treatment of its ware is not much different from that of Bahadarabad or Ambkheri, but it has not yielded so far any specialized Harappan shape. The problem is complicated by the Copper Hoards. Typologically and from the nature of their metal content, they are different from Harappan bronze implements. It seems possible to imagine, therefore, that they were being supplied to the straggling Harappan people and others by local craftsmen. Atranjikhera could have been a settlement of these craftsmen but we are far from certain about it.

Ghosh had suggested that the origin of the Harappa culture has perhaps to be looked for within the culture itself. I suggest also that the indication of the decay of the culture perhaps lie within it. I mean that one of the major causes which might have brought about its downfall was its sweeping expansion; in other words, because it over-reached itself. Groups of Harappan folk marching into fresh and untrodden lands under a leader would carve out a small principality for themselves, perhaps at loggerheads with other similar groups, and with little or no tie with their original home and its ruler. Divided and bereft of cohesion, they would weaken themselves, and fall a prey to the slightest blow by an organized invader.

The eastern expansion of the Harappa people displays a series of regressions. Starting from Harappa, the stages of regressions are perhaps at present demonstrated at Kotla-Nihang Khan, Kalibangan, Rupar, Alamgirpur, Bara, Bhatpura, Ambkheri, and lastly Bahadarabad with a mark of interrogation. We notice in

this series that each succeeding stage keeps losing some essential Harappan trait or equipment, till we find an impoverished people with poor pottery and little else, so impoverished that they are difficult even to identify.

Among these sites, it is only from Kalibangan that we have Carbon-14 dates. It is, therefore, necessary to obtain such dates also for the other sites named above. Till that is done, would it be too much to postulate a period of, say, 400 years between the end of Kalibangan and Ambkheri? This may bring us to 1400 B. C. or even later for the end of Harappa culture in the upper Ganga Valley. In fact, one is tempted to say that the terminal date of 1200 B. C. suggested by Fairservis (1956b, 953-56) deserves due consideration.

In Saurashtra, the end may have come much earlier, although S. R. Rao the excavator of Lothal and Rangpur, does not think so. I feel that the extent of degeneration from Rangpur II A to II B is not of the same order, as, let us say, from Kalibangan to Ambkheri. The end of Rangpur II B may be coeval with the end of Rupar. It is also not very clear what happened to the Lustrous Red Ware people—the descendants of Harappans in Saurashtra.

H. D. Sankalia :

Subbarao and I myself had already noted the significance of the Sothi pottery, to which attention has first been drawn by Ghosh. Of course, in the then context we could not say whether it was identical with the Harappa Ware or different. But now it turns out to be slightly earlier than the Indus pottery and is called "Proto-Harappan".

Regarding the so-called "Ochre-Coloured Pottery" I feel that this term is a misnomer, because the colour is not due to a deliberate action by the potter, but was the result of water-logging or because the pottery has remained in the river silt for a long time. This nomenclature should be given up. A much more important thing is that the shapes of this pottery from all the sites known today in the Ganga-Yamuna Doab should be drawn and published immediately. It will then be possible to compare it with the Harappan pottery and say whether it is the deterioration of the latter or something different.

B. K. Thapar :

Ghosh in his paper refers to the sobriquet Sothi for the culture represented by the non-Harappan pottery noticed by him on some of the sites on the Drishadvati and, in view of its widespread diffusion in Rajasthan and its stratigraphical priority to the Harappan, as established by the recent excavation at Kalibangan, invites the participants to give a final name to it. Besides Sothi, he has suggested such names as Sarasvati, Ghaggar, and Kalibangan I. Of these, both Sarasvati and Ghaggar are inappropriate, the former for its present-day geographical inapplicability and the latter for the restricted spatial extent in relation to the known geographical distribution of the characteristic pottery. Further more, in adopting such

names we may obviously commit the same initial mistake as was done by the designators of the 'Indus Valley Civilization' the ambit of which was, by later investigations, found to extend much beyond the confines of the Indus Valley proper. In the accepted archaeological parlance, more precise designations of a ceramic or a culture follow the place-names where the distintcive elements of that specific ceramic or culture are first identified. We are, therefore, to choose between Sothi and Kalibangan I.

Sothi Ware as a distinct non-Harappan ceramic was identified in 1953. After the initial feeling of the explorer himself, it was believed to represent a culture of the interregnum between the Harappan and the later cultures. Less than a decade later, its stratigraphical position was established by the excavation at Kalibangan within the same region. If the principle of priority in discovery or identification has to be earnestly applied, Sothi claims the title. Apart from this, as GHOSH himself felt, the name Sothi culture has since been referred to by many distinguished archaeologists, and lest the impression is left on the unwary readers that Sothi Culture is something different (of post-Harappan affiliation) from the stratigraphically established Kalibangan I (of pre-Harappan vintage), it would be desirable to avoid the confusion at this very stage when its antecedents have been fully investigated. This, however, is not without difficulties, and the choice has to be made discreetly. Whereas in Kalibangan I many component elements of the pre-Harappa cultures were identified, viz. architecture, pottery, metallurgy, other arts and industries like those of blades, beads, bangles, including plastic art of terracota, at Sothi only the distinctive ceramic was isolated. The term Sothi culture, which is already current under the new garb, as affirmed by Y. D. SHARMA, therefore, assumes definition by derivation from the Kalibangan evidence. Its application thus falls short of the qualifications of a 'culture' which is defined as 'an assemblage of industries made by people of the same stock.' At the same time it must be recognized that Sothi is a single-culture site as opposed to the two-fold sequence of Kalibangan. One has to consider the claims of the former from this angle as well.

Coming to the evidence from the excavation at Kalibangan. The pottery of the pre-Harappan period was characterized by six fabrics, each distinct in kind and range. These have been labelled for convenience, fabrics A to F. Fabric A was carelessly potted betraying unskilled handling with tell-tale traces of irregular striations. It was light and thin in section and red to pinkish in surface colour and was painted in black combined at times with white Fabric B, of red ware, was carefully potted and showed roughened or rusticated surface with horizontal or wavy combings or tortoise shell or dendritic impressions. Fabric C was marked by a finer-textured paste and all-over smooth slipped surface in shades of red and plum- or purple-red. Fabric D was characterized by vessels with thick sturdy section and slipped red surface, mainly represented by basins showing all over obtusely incised patterns on the inner side and single and multiple rows of cord-impressions on the outside. Fabrics E and F represented respectively the buff—and grey-slipped wares.

To recapitulate the diagnostic traits. Fabric A was marked by an individuality which isolated it from the other fabrics. Fabric B, while individualistic in its surface treatment including the decorative theme, showed affinities with Fabric C in paste-texture including potting and in vase-forms. Its surface elaboration simulates the Quetta Wet-Wares. Fabric D was distinguished by an exclusive decorative (incised) pattern and its sturdy look. In frequency, Fabrics E and F were somewhat uncommon, the latter being particularly scarce. Amongst Fabrics C–F the difference was more apprent than real and lay essentially in the colour of the surface–dressing or thickness and size of the body. This is amply borne out by inter-correspondence in forms like jars with short and ledged shoulders, offering-stands, lids, bowls and basins etc. Some of the forms and the painted designs amongst these fabrics show a generic relationship with the Sind-Baluch sites of pre-Harappan vintage. Ghosh has documented quite a few parallels and many more could still be added by persistent search as conceded by him. A firm substratum, designated by him as Sothi, in the make-up of the Harappa is clearly established. Whether this substratum stands in parental position to the Harappa cannot at present be positively affirmed. Further field-work both in India and in Pakistan would solve the problem. In anticipation, however, it may be observed that while between the two assemblages there are such apparent differences as the orientation of the houses, size of bricks, range of ceramics, the size and material of blades and the marked absence of the seals in the pre-Harappan cultures, some elements in the pottery, viz. fish-scale, pipal-leaf, and external cord-impression including graffitti marks, notably arrow, in decorative themes and dish-on-stand, ring-stand and lids in forms, besides terracotta bulls and toy cart-wheels, shell and terracotta bangles, steatite disk beads, quern-stones, as also knowledge of metallurgy and the 'English Bond' in masonry are shared by both. Furthermore, there is evidence to show that the Harappans, on arrival at Kalibangan, while introducing their regimented pattern of life with a high level of material civilization, also co-lived with the earlier settlers for sometime. It is tempting to postulate, therefore, a relationship between the two cultures. At the same time it cannot be averred that the element of the Indus Civilization developed out of Sothi substratum locally at Kalibangan or for that matter in the Ghaggar valley itself. If that were so we shall have to explain the diffusion of the Indus Civilization in the light of the present day distribution. From the above showing it would appear that the Indus Civilization could be a natural evolution through diffusion or inter-action from some industries of the substratum but the evolution seems to be complete when the distinctive culture came to the sub-continent in the form we see at Mohenjo-daro, Harappa, Kalibangan and Lothal etc. The pre-Harappan elements at Harappa, Kalibangan, and in conjunction, the Ghaggar valley sites (in other words the Sothi substratum) may be the result of an expansive movement of village communities sharing between themselves basic elements but evolving their own patterns in each region. This would perhaps explain the various ramifications within this stratum. The pre-Harappan culture at Kalibangan was with an initial overlap supplanted by the Harappan with fully evolved elements like the 'citadel'

vis-a-vis the 'lower city', painted pottery tradition, city planning and an individualistic script. None of these elements seem to have evolved at Kalibangan ; the visibly tenuous links in pottery and other crafts are equally not a local growth.

Lastly, I would draw attention to the Gujarat phase of the Harappan which shows a different development pattern as compared with that of Sind, Punjab and Rajasthan. Each of the four excavated sites–Rangpur, Lothal, Prabhas-Patan, and Rojdi—shows a separate tradition, apparently cellular like those of the village communities in Baluchistan. They were co-existing within short distances of one another and yet showing different patterns notably in pottery tradition. What do these local variations signify ? There is no denying that at some stage these were contemporary. At the same time, some of the ceramic traditions which also show early traits, the diffusion of which needs closer investigation.

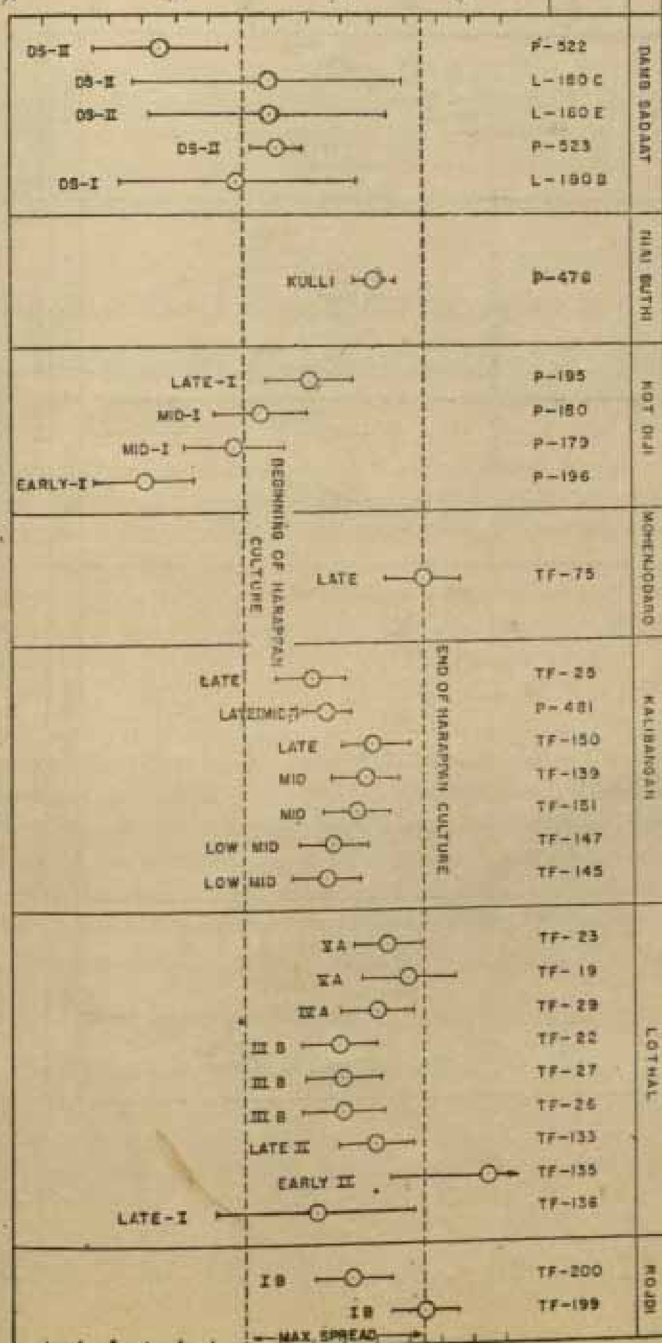
Kenneth A. R. Kennedy :

I have just returned from the Anthropological Survey of India in Calcutta where the skeletal series from Mohenjo-daro, Harappa, and Lothal were made available to me for examination through the courtesy of SEN. I find no evidence to support the contentions that "Mongoloid" racial features are present in these specimens. As with the case of "Proto-Australoid" traits which some scholars have selected as an important feature of these skeletons, so are "Mongoloid" traits to be found among ethnics whose racial ties are not necessarily derived from eastern and southern Asiatic strains. It was the recognition of "Australoid" morphological traits among some of the Bronze Age human remains of Europe that led Sir Arthur KEITH to favour the term "Caucasic" for this widely diffused physical complex. The biological affinities of the ancient inhabitants of Mohenjo-daro, Harappa, and Lothal (the latter site yielding thus far a number of skulls of which the most complete are of males only) are with the peoples of Southwestern Asia. Their phenotypes survive to the present day in Sind, the Punjab, and in Gujarat.

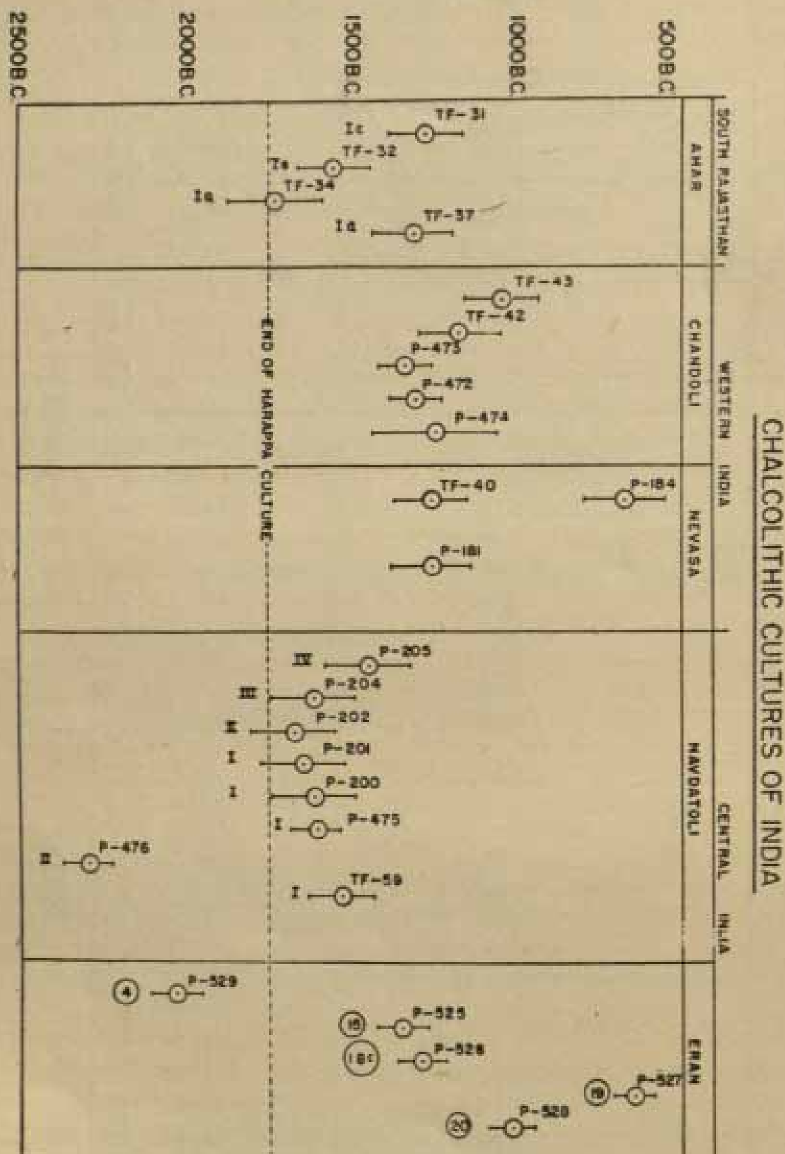
D. P. Agrawal :

I will here confine myself to the chronology of the Harappa Culture. It a recent paper (AGRAWAL, 1964, 850) I have tried to analyse all the available radiocarbon dates for the Harappan and allied sites to arrive at a consistent chronology for this culture. I would not repeat the argument here again, but the enclosed plot (fig. 1) would clearly show that the total time-spread of this culture was covered by the date bracket of c. 2300-1750 B. C. GHOSH also has almost agreed to this chronology of the Harappa Culture.

This date bracket is not contradicted by the archaeological evidence either. One of the alleged pre-Sargonid seals was found alongwith a stone pommel of Sargonid date and LANGDON (1931, 593) admitted that "both the things might have fallen from above". Another Indus type seal formerly associated with the elusive II Dynasty of Ur was later suspected by WOOLLEY to be of Sargonid date. No definite archeological evidence of the Harappan's contacts with the West in pre-Sargonid times is available. We get definite contacts only between the Sargonid and Isin-Larsa periods which is well covered by the proposed bracket of c. 2300-1750 B. C.



HARAPPAN & PRE-HARAPPAN CULTURES.
AGE IN YEARS (B.C.)
3000B.C.
2500B.C.
2000B.C.
1800B.C.
SITE
STATION INDEX NO.
DAMB SADAAT
P-522
L-180C
L-180E
P-523
L-180B
NIN BUTHI
KULLI
P-478
KOT DIJI
LATE-I
MID-I
EARLY-I
P-195
P-180
P-179
P-196
MOHENJODARO
LATE
TF-75
KALIBANGAN
TF-25
P-481
TF-150
TF-139
TF-151
TF-147
TF-145
LOW MID
LOTHAL
TF-23
TF-19
TF-29
TF-22
TF-27
TF-26
TF-133
TF-135
TF-136
EARLY II
LATE-I
ROJDI
TF-200
TF-199
BEGINNING OF HARAPPAN CULTURE
END OF HARAPPAN CULTURE
MAX SPREAD


AGE IN YEARS - B.C.
2500 B.C.
2000 B.C.
1500 B.C.
1000 B.C.
500 B.C.
CHALCOLITHIC CULTURES OF INDIA
SOUTH RAJASTHAN
AHAR
WESTERN INDIA
CHANDOLI
NEVASA
CENTRAL INDIA
NAVDATOLI
ERAN
END OF HARAPPA CULTURE
TF-31
TF-32
TF-34
TF-37
TF-43
TF-42
P-475
P-472
P-474
TF-40
P-184
P-181
P-205
P-204
P-202
P-201
P-200
P-475
P-476
TF-59
P-529
P-525
P-526
P-527
P-528

One more point. So much emphasis was laid on terminology in this Seminar. Yet use of "Indus Civilization" in the place of the accepted term "Harappa Culture" is rather unfortunate. It should no more be confined to the Indus only but should be recognised by the name of the type site.

N. R. Banerjee :

I have to draw attention to the find of dishes-on-stand in red ware at Ahichchhatra including the type with corrugated stem that was found at Hastinapura in the Painted Gray Ware level. This type is also represented in the Chalcolithic culture at Nagda. These may represent survivals from the Indus Valley Civilization into the later period of the Painted Grey Ware.

M. K. Dhavalikar :

GHOSH has mentioned S. S. SARKAR's (1964) view that the Harappan people of Mohenjo-daro have similarities with the present day people of Sind, those of Harappa with the people of the Punjab, and those of Lothal with the people of Gujarat. I would mention certain other conclusions arrived at by SARKAR. These are :

1. The skeletons from Cemetery R-37 and Cemetery H—Stratum II showing a cranial index of 71, are Indo-Caspians, a term which he prefers to Indo-Aryans for obvious reasons. These people according to him, are akin to those of Tepe Hissar I and II.

2. Further, the people of the Cemetary H–Pot Burials and Area G, showing a cranial index of 76, are also Indo-Caspians. These are akin to the people of Tepe Hissar III.

3. The people of Shahi Tump, accoring to him are also Indo-Caspians.

From the observations of SARKAR it is now obvious that these poeple, the Indo-Caspians or the Indo-Aryans, should not be confused with the Vedic Aryans. For, the latter used horse and chariots and supposedly knew iron. Now, therefore, time has come to think of Aryans without horse and chariot and iron as well.

All this shows the existence of Indo-Caspians at Harappa where the basic strain, however, was Australoid. Further, from SARKAR's conclusions we can discern three distinct waves of Aryan immigration into India as follows :

1. The first wave represented at Cemetery R-37 and Cemetery H–Stratum II.

2. The second wave at Cemetary H Pot Burials and Area G.

3. The third wave represented at Shahi Tump.

Furthermore, it is interesting to note that the people of Cemetary H–Pot Burials and Area G are akin to those from Tepe Hissar III. The latter were probably of Scythian origin and had possibly arrived from Ukraine and Central Russia. It would not therefore be wrong to say that the forefathers of the Sakas were already there in the Indus Valley and they were as ancient to the Sakas themselves as the latter are to us.

R. C. Gaur :

I shall put before you the results of the excavations carried out by the History Department of Aligarh Muslim University at Atranjikhera in Etah District of U. P. in 1963 and 1964 and discuss the significance of these results for the problem of Indus Civilization. Atranjikhera is perhaps the only site in the upper Ganga-Yamuna Doab to reveal a continuity of occupation from the caliest phase of the Proto-historic period down to the end of the Medieval period. Of interest to us in the present context are the following three pre-N. B. P. periods.

Period I —Ochre Colour Pottery.
Period II —Black-and-Red Ware.
Period III —P. G. Ware.

While the existence of the O. C. P. and P. G. Ware periods had been known earlier, the Black-and-Red Ware period intervening between the O. C. P. and P. G. Ware periods has come to light for the first time. Radiocarbon examination of a charcoal sample from the middle levels of the P. G. Ware phase (not from the earliest layers as mistakenly reported in the *Bulletin of the Tata Institute of Fundamental Research*, Bombay) has given the date of 1025 ± 125.

Period I— Ochre Coloured Pottery

An area of approximately 260 sq. meters of this industry has been exposed. The thickness of the deposit ranges from 0·80 meter to 1·50 meter, the average being 1 meter. This phase has yielded two types of pottery. (a) Ochre Coloured Pottery and (b) Dull red ware. The O. C. P. sherds found here are wheel turned, porous and so fragile that powder comes out even if slightly rubbed. The majority of the sherds are thick and the edges are rolled. In these respects this pottery is similar to that found in the excavations at Bahadarabad, Ambkheri and Hastinapura, and in the explorations at Manupur, Bhatpura etc. The common shapes are bowls, vases, knobbed lids, dishes-on-stand, and handles, the most frequent being vases with flared rims of different types and sizes. A large number of the sherds reveal a thick red slip. The decorations comprise primarily of incised designs such as triangular notches, notches between parallel lines, wavy lines and rectangular lines making a check design. This decoration in such variety has not been noticed in the O. C. P. of the other sites. On some of the red slipped ware faint marks of parallel bands in black paint were also observed. Although common shapes have been found at all the sites, it appears that the O. C. P. of Atranjikhera has distinct local characteristics.

As in the case of other sites, the O. C. P. deposit at Atranjikhera has so far not yielded hearths and charcoal. The definite presence of sand and evidence of flood which washed away considerable part of the section on the western side suggests that perhaps the entire deposit had been subjected to flooding. However, two distinct horizontal layers could be marked on the basis of a difference in the colour of the soil and the density of the pottery. In between the two layers a layer of rammed earth mixed with kankar and pot-sherds, about 10 cm. thick, was noticed. This may indicate the existence of a habitational floor level. However, the earlier deposit has yielded a greater density of pottery with determinable shapes.

Period II—Black-And-Red Ware.

Black-and-Red Ware phase was found in an area of approximately 300 sq. meters. Although it was mostly found over the O.C.P. layers, on the southern side it was found right on the natural soil. In the central area it was found above the O. C. P. and below the P. G. Ware phase. In the north the layers of this phase tended to become thinner and then probably disappeared altogether. At this place P. G. Ware was found just above the O. C. P. The deposit is comparatively thin varying between 25 and 50 cm.

The pottery complex comprises Black-and-Red and black-slipped wares showing almost common technique and shapes and red slipped and unslipped wares. There is a complete absence of O .C. P. and its associated pottery as well as of P. G. Ware. There is also a marked difference between the associated red pottery of this phase and that of the P.G. Ware phase. It may therefore be safely stated that there was a Black-and-Red Ware period qualitatively different from the O. C. P. and P. G. Ware periods. Another distinctive feature of the period is the presence of a large number of pieces of small chalcedony cores and flakes along with a few tiny pieces of the cores and flakes of carnelian. This may perhaps suggest some remote affinity with the painted Black-and-Red pottery of Lothal and Rangpur on the one hand and of Ahar on the other. Another important find from this period was a small piece of bone comb.

The Black-and-Red as well as black-slipped pottery is of a fine quality. It is made out of well-levigated clay, is generally thin and well-burnt. The process of inverted firing gives a smooth surface while the smoothness of the slip suggests that it was turned on a fast wheel. The high quality of lusture was perhaps due to burnishing. A significant feature of these sherds is that in addition to the usual wheel-turned bowls and dishes, a number of new shapes were also found such as those of vases and cups, a few being hand-made.

The bulk of the associated red ware is unslipped and of medium fabric, the common shapes being vases. The slipped ware is made of smooth paste and is better burnt, occsionally having painted designs, similar to those commonly found in the P. G. Ware period. The entire associated red ware is invariably wheel-turned.

From the layers of this phase well-preserved hearths could be excavated. These are oblong in shape and squat. Charcoal and charred bones collected from these hearths have been sent for C-14 dating.

Period III—Painted Grey Ware.

The richest deposit of the Proto-historic period is of P. G. Ware, which has been found in an area of approximately 600 sq. meters. The thickness of the deposits varies between 0·80 meter and 2·00 meters.

It has been possible to divide this period into at least five definite sub-phases, on the basis of stratification, floor levels, domestic as well as community hearths, and a potter's kiln. A large number of domestic hearths as well as the so-called community hearths were found from different levels. The domestic hearths are usually semi-oval in shape and 25 cm to 35 cm high, and are made of mud. The community hearths are in the nature of circular pits with rounded tapering

clay lumps lying inside. Perhaps these lumps were used to support the cooking pots. In or near these hearths were found pots, implements, and charred animal bones in considerable quantities. Presence of post-holes over thick mud floors suggests thatched roofing over bamboo or wooden posts. A few patches of hard clay might possibly be the remains of a mud wall. The presence of an occasional mud brick and pieces of burnt bricks suggest that these were used, but presumably infrequently. Plaster pieces with red marks which were found in abundance were perhaps used for closing the kilns for making pottery. These pieces bear a remarkable resemblance to similar plaster pieces in vogue in the village pottery kilns even today.

Iron tools and implements have been found in all the sub-phases of the period. These include spearheads, arrowheads, knives, an iron axe, a pair of kitchen tongs (the latter two from the late sub-phases) and two probable fish hooks.

Though Painted Grey Ware is the characteristic pottery of the period, it seems that this ware represented only the sophisticated pottery and not the common pots and pans. The incidence of P. G. Ware ranges between 3% to 10% of the total pottery complex. Alongside this ware were found a plain grey ware, Black-and-Red, and black-slipped ware and of course, slipped as well as unslipped red ware, the last mentioned forming the bulk of the complex.

In fabric the P.G. Ware is similar to that found at other sites. However, a very large number of new designs and shapes were found. The pottery kiln yielded a particularly rich variety of shapes and decorations.

The P. G. Ware and the plain grey ware show a remarkable similarity in shape, fabric, and technique to the Black-and-Red and black-slipped pottery of the preceding period. However, the complex of the red pottery is quite different. The bulk of the unslipped dull red ware of this period is hand-made except for the rims, whereas the associated red ware of Period II is almost entirely wheel-turned. Another feature which distinguishes this phase from the previous one is the abundance of antiquities like plain and designed terracotta discs, terracotta and semi-precious stone beads, terracotta pendants, long stylus, copper antimony rods, etc.

In the earlier sub-phases black-slipped and Black-and-Red wares are found in greater frequency than P.G. Ware, suggesting a period of transition. The second sub-phase, however, shows an intensive activity in making the new type of pottery. Not only is the percentage of the P.G. sherds highest in this sub-phase, but it is also the richest from the point of view of designs and shapes. In the third and fourth sub-phases, more or less the same tendency continues. In the last phase the decline of P. G. Ware industry becomes apparent.

In the post-P. G. Ware period, both P. G. Ware as well as plain grey ware continue. However, this pottery becomes crude and the painting gets coarser. Gradually even this disapperas. The plain grey ware, however, continues for a much longer time, though decadence is noticeable even in this industry. On the other hand, the black-slipped ware shows a continuous process of improvement, particularly in fineness and lustre. Perhaps it directly developed into the NBP.

While these excavations have brought interesting data to light they have also raised some fresh problems.

(i) The C-14 date from the lowest levels of the Black-and-Red Ware phase probably indicates the latest limits of the O. C. P. period. In case this period was contemporaneous with the late Harappa period, the question arises as to why did the upper Ganga-Yamuna Doab remain impervious to the more advanced Harappa culture?

(ii) Does the O. C. P. found in upper Ganga basin and that found at Atranjikhera constitute a single culture, or different cultural traditions?

(iii) Inspite of the fact that O. C. P. has been excavated from fairly thick deposits over a large area at Bahadarabad, Ambkheri and Atranjikhera, no habitational layers have been found anywhere. To know the other aspects of this culture we have to find sites where no water-logging has taken place.

(iv) There is no evidence of an overlap between O. C. P. and Black-and-Red Ware phases. At the same time no stratigraphic gap between the two periods has been found.

(v) Who were the makers of the Black-and-Red Ware? What is the relationship of this Black-and-Red Ware with that of Lothal and Ahar? The resemblance between the Black-and-Red and P. G. Wares and the definite continuty of the industry suggest a gradual transition, but how should we explain the differences between associated red ware of the Black-and-Red Ware and the P. G.Ware phases?

(vi) Even the earliest phase of the P. G. Ware has yielded iron but it is totally absent in the Black-and-Red Ware phase. If it is assumed that Black-and Red pottery represented the culture of the early Aryans, then it follows that iron was brought into India by a later wave of Aryan immigrants. In that case, why is iron mentioned so frequently in the *Rigveda*. If the word *Ayas* (अयस्) does not mean iron, which other word is used in the Vedas for this metal?

(vii) On the basis of the C–14 dating of 1025 B. C. relating to the mid-phases of P. G. Ware culture, it may be inferred that the people of this culture settled down in the Ganga valley around 1200 B. C. It is unlikely that iron could have been introduced in India much before that date. If *Ayas* (अयस्) is to be interpreted merely a metal and *Krishna-Ayas* (कृष्ण अयस्) of the later Vedas as iron, does it mean that the P. G. Ware culture corresponds to the post-Rigvedic phase of Aryan Civilization ? In such an event, would it be correct to assume that the Rigvedic Aryans did not proceed beyond the Ghaggar Valley, while a subsequent wave of Aryan immigrants who brought iron with them spread to the Ganga Valley and it is their culture which is represented by the later Vedas?

I hope that the learned scholars at this Seminar would give their thought to these problems and throw light on possible solutions.

A. K. Ghosh :

During his comment on GHOSH's paper DHAKY has raised one fundamental point regarding the ethnic type and environment. He has suggested that I should say something on this problem.

It is common scientific knowledge that both environment and heredity exercise their influence on ethnic types. Studies on the skeletal remains from Harappa reveal that the Harappans have closer affinities with the present day Chuhras and the Sikhs of the Punjab. DHAKY's suggestion is that the environment has influenced the racial types of the people inhabiting that area. Heredity greatly influences somatological characters of the population. But environment cannot change the racial characteristics of a particular population. Large data are required before we can come to some conclusions. In this respect excavation of more Harappan sites and thereby collection of more skeletal remains, anthorpometric work on the already collected materials, measurements and finding out other criteria will sufficiently increase the data. Anthropological data from the local present-day population are also necessary to link up the past with the present.

S. P. Gupta :

Of the many problems dealt with by GHOSH I would like to touch upon only that connected with the Ochre Coloured Ware. The problem involves three questions : firstly, is there any ware with individualistic traits of typology, firing, fabric, and decorative designs which may be given a definite name to differentiate it from other wares; secondly, is it possible to associate it with the Copper Hoards of the Gangetic basin.

To begin with, the O. C. Ware from Atranjikhera seems to be sufficiently individualistic in typology and designs. This evidence is strengthened by the pottery from Bahadarabad. Revising his earlier stand, Y. D. SHARMA feels that the pottery from this site also looks largely to be non-Harappan. The pottery collected in the name of the O. C. Ware by B. B. LAL from Hastinapura, Rajapur Parsu and Bisauli was also never claimed to be Harappan, even remotely. Though these evidences may not be treated as conclusive, it seems quite probable that there does exist a pre-P. G. Ware horizon with a non-Harappan ware which has enough of individualistic features to be given a separate name of the O. C. Ware. However the pottery from Ambkheri cannot be included under this Ware. I agree with SHARMA in designating it as Harappan. The indecision that exists in phrases like 'the O.C. Ware' that is 'Late Harappan Ware' must now end for ever. Either it is O. C. Ware or it is not O. C. Ware. But it does not mean that the O. C. Ware existed in isolation. Since the Late Harappan culture of western U. P. seems to be contemporary and is a close neighbour of the O. C. Ware, the two may often be found together, as it is likely to have happened at Bahadarabad. To me the Bahadarabad pottery assemblage includes both the Late Harappan and the O. C. Wares. The place of the origin of this ware, however, is not yet certain but it could be anywhere between Kanpur and Etah since the pre-P. G. Ware levels at Kaushambi, Rajghat, Sonepur etc. do not yield this pottery and the districts of Meerut, Bulandhsahar, etc. have been found dominated by the Late Harappan culture. This suggestion is based on the process of elimination which may seem to be convincing but never conclusive and, therefore, should be treated as tentative.

On the question of assoicating the O. C. Ware with the Hoards something peculiar exists. The same scholar accepts this hypothesis put forward by LAL and

still keeps on saying that the whole complex is Late Harappan. It is not possible. LAL has conclusively shown that the Hoards are absolutely non-Harappan, and now that we agree to disassociate the O. C. Ware from the Late Harappan ware, there does not remain any argument in favour of associating the Hoards and the O. C. Ware with the Harappans. However, if we still insist on it we are faced with a peculiar situation : it will imply that the Hoards originated in western U. P. since they have been found in Bengal and Orissa also, in one sense or the other, we imply the extension of the Late Harappa culture upto the eastern coast, an obvious conclusion which we are not in a position to prove on any grounds unless we start saying that the Hoards of the eastern states have absolutely no relation with those from the Ganga-Yamuna Doab. But even this plea would demand the so-far non-existing evidences of the extension of the Late Harappa culture from the districts of Kanpur and Unnao, if not Allahabad which too has yielded a copper celt.

The situation seems to be slightly different. Because of the proximity of the site and the copper ores and the simplicity of the forms of the tools like the shouldered axe, flat axe, bar celt, and ring—the dominant tool types of the eastern states—it is felt that the Hoards originated somewhere in Bihar or Chhota Nagpur from where they moved into the Gangetic Valley. It is at the latter place that these types were augmented by a few new types like the harpoons, swords and anthropomorphic figures, which people evolved to face the new problems of a new environment, may be to fight the aboriginals there and hunt big game, including big fish. Thus, the industry was constantly evolving in time and space. It is in the Doab that these nomadic people settled down in places where aboriginal people were using the O. C. Ware. It is here that they came into contact with the northward moving Chalcolithic culture from Malwa and the eastward moving culture of the Late Harappans. Traces of this contact in metallic tools are seen in some of the low-grade bronze tools from the Chalcolithic sites of Navdatoli and Chandoli, and in pottery in the O. C. Ware collected at Bahadarabad. I agree with LAL that the Hoard people might have been the 'Mundas' who once expanded from Bihar to Garhwal and then again retreated. The presence of 'Munda' speech amongst the Pahari group of languages and the proto-Austroloid people in Doms, Koltas, etc. in the Indo-Aryan population of the cis-Himalayan region amply testify to this story of migration and return. GRIERSON, RISLEY and other leading anthropologists have supported this theory.

In the end, I would like to inform the scholars that at least two harpoons and two swords from the Hoards are of low-grade bronze containg 6 to 7% tin and not of pure copper. SMITH had mentioned this fact very clearly. And then, the antennae sword from Kallur has 9·5% of tin according to the analysis conducted by Dr. LAL. Thus the use of low-grade bronze for tool-making was known to the Hoard people, at least in the Ganga-Yamuna Doab.

V. N. Misra :

DHAKY has referred to my discovering Harappan elements at the Ahar Culture sites in south Rajasthan. Since this statement is likely to arouse much

curiosity, I must clarify the position on this subject. Recently I collected some surface pottery from several mounds of the Ahar Culture in Udaipur and Chitorgarh Districts, but owing to my preoccupation with other things, I have not been able to examine it so far. I showed some sherds to DHAKY and he recognized them to be identical with certain pottery forms of the Harappa culture of Saurashtra. The sherds in question belong to carinated dishes-on-stand, of a fine tan coloured fabric. Identical forms also occur at Ahar and Gilund. S. R. RAO after examining these sherds believes that they are unmistakably Harappan in fabric and type and have identical parallels at Rangpur. For any further light on this subject I invite the specialists present here to examine the pottery for themselves.

RAO has referred to Micaceous Red Ware people as one of the contributors to the Harappa Civilization in Saurashtra. However, he admits that at no place so far a purely Micaceous Red Ware horizon has been isolated. It appears to me, therefore, that in the present state of our knowledge, we may not be quite justified in speaking of Micaceous Red Ware people. For, a people in archaeology means a culture. Micaceous Red ware (or Pink Ware as DHAKY likes to call it) in Saurashtra is one of the elements of the Harappa Culture but is not a culture by itself.

A good deal of the discussion here has been centred around the racial composition of the Harappan peoples. However, it is well-known that some of the racial strains have been identified on the basis of only one or a few skeletons. It is widely recognized that the concept of race is applicable to groups and populations and not to single individuals. This is more true in the case of skeletons, for the criteria available there for race determination are fewer than in the case of living populations. Extreme variations of stature, head form etc. occur among the individual members of the same race, nay in the same family. Thus until a failry large skeletal material is avilable for study, we may not be very sure regarding the identification of racial groups. The paucity of skeletal material is perhaps one reason why experts sometimes differ so strongly regarding the identification of racial stains.

The subject of 'Copper Hoards' has inevitably cropped up in the discussion on the Ochre-Coloured Pottery. S. P. GUPTA has suggested that the 'Copper Hoard' types of Bihar-Orissa Zone are earlier in date and the types found in U. P. have evolved out of the former. The basis of his theory is that the Bihar-Orissa types, namely flat celt, and shouldered celt are common to U. P., as well, but harpoon, anthropomorphic form, antennae-hilted sword, and spear are restricted to U. P. alone. This distribution is certainly true, but the theory that the specialised U. P. forms have evolved out of the generalized Bihar-Orissa types has little to commend it. The four specialized U. P. types named above are so markedly different from the generalized eastern forms that they can not be concieved to have evolved out of the latter by any stretch of imagination. If any clues regarding the origin of these types are to be sought, they are diffusionary and from Western Asia as has been repeatedly pointed out by Robert HEINE GELDERN. Admittedly, the evidence even from that direction is limited but beyond that, the best course in the matter for the moment is to profess our ignorance.

V. S. Wakankar :

While considering the extent of Harappan Culture, it is necessary to study the evidence found during the excavation of a small site on the Chambal river in Mandsaur District of Madhya Pradesh. During a survey of the Chambal valley area which was to be submerged under the Gandhi Sagar waters, TRIVEDI and myself excavated a few sites of historic, Chalcolithic and prehistoric periods. Manoti, a small village situated a mile to the east of the Chambal on the northern bank of a small tributary nullah, and Awra, another site further southwards, have shown that habitation at these sites started much ealier than the Malwa Chalcolithic phase and pottery akin to Ahar and Harappan (painted Black-and-Red Ware, typical small jars of Harappa, and dull black dish-on-stand) was found in their lowest levels. It is Manoti where we get a clear picture in the form of Harappan pottery, raised platforms, city defence walls, and a doubtful seal of soapstone.

This site was twice hit by high floods of Chambal in its earliest phase and the people had to raise the level by erecting a rectangular platform of sundried bricks of different dimensions. They also erected a huge defence wall of similar bricks nearly 11 ft. in width and at least 10 to 12 feet in height. The remains of walls which we excavated were hardly 4 feet in height but the fallen debris of the wall on either side of it may lead us to that conclusion. Inside the wall few more brick structures were located but outside there was also some habitation as is evident by habitational layers resting against the wall.

We could detect the wall rising from a right angle in southwest corner, towards east to an extent of 60 feet and towards north to 150 ft. It is the pre-defence deposit that yieleded the Harappan materials. The pottery pieces were so small that it was difficult to get an exact idea of the full shape. Painted Black-and-Red Ware continues right upto the lowest levels. The pre-defence layers of 4 feet with interruption of two flood-indications in the form of fine sand deposits have yielded a creamy thin jar with impressions of some ochre lining in the upper half and a coarse dull black dish-on-stand. Few pieces of finely levigated and well-fired pottery with lustrous lining and washes were also found. I had examined similar findings in Lothal pottery.

The general position of the deposit is as follows :

13 feet at the top, Mauryan and Late Historic deposit.

8 feet Malwa Ware.

12 feet Painted Black-and-Red Ware only.

4 feet Black-and-Red Ware deposits resting against the defence wall.

3 feet Brick platform.

3 to 4 feet, Harappan with interruptions by Chambal floods.

As the site was to be submerged under the Gandhi Sagar waters and the time limit and the funds at our disposal were short, we could not carry out an extensive excavation of such an important site. While detecting the wall on eastern side a greenish soapstone seal was found in upper layers resting over the walls, but its affinity with Harappan is doubtful.

It is worth-noting that this was the only Chalcolithic site in Malwa where burnt brick structures were found in *pucca* drainage and a wall.

We had invited many prominent archaeologists to come and see this unique site of Malwa, but, due to their busy programmes elsewhere, none could come to see it and unfortunately we saw it slowly and gradually submerging in the rising of waters of the Gandhi Sagar, a unique site lost for ever.

K. V. Soundara Rajan :

A sudden urge to systematize the local government and social structure resulted in the standardization of the minutiae of the culture and civilization. Enforcement of these was obviously stern. Technology was given a high place but subservient to socio-political rulership. In short, like the Egyptian, Sumerian, and Chinese civilizations, the Indus Civilization also promoted its own norms of civilized living, fashions, or vogue, to adjacent zones and herein lie the common *bonds* of Harappan sites in Rajasthan and Gujarat, highlighted by local differences.

It is significant that the end of the Harappan stage of Lothal and the Black-and-Red Ware epoch of Ahar are coeval. This would mean that the Banas Culture was the dominant post-Harappan culture in south Rajasthan, Gujarat, and Central India, while in north Rajasthan and Punjab, it is the 'Sothi' culture which precedes the Painted Grey Ware.

It is seen that the Painted Grey Ware is preceded at a number of places in east Rajasthan (Noh) and Western Gangetic valley (Hastinapura, Atranjikhera etc.) by the Ochre-Coloured Ware. On the other hand, the 'Sothi culture, which is taken to be proto-Harappan, has itself many affinities with the ensemble of the Ochre-Coloured Ware. This could only be reconciled by the fact that 'Sothi' culture, Harappan and Ochre-Coloured Ware are facets of one and the same culture-evolution, with inception, climax, and degeneration represented by these. The snag in the argument, however, comes up when we find that at two closely located places like Alamgirpur and Hastinapura, we have two sets of culture sequences, the former revealing a basically Harappan culture in the earliest level while in the later it is the Ochre-Coloured Ware. It is perhaps possible to argue that the most easterly point of diffusion of the Harappan was Alamgirpur on the Hindon, while further east on the Ganga proper a devolution had already taken place. If so, the legitimate question would arise as to what prevented the Harappans from moving from the Hindon into the Ganga valley, particularly when no physiomorphic barrier existed? Or did any cultural barrier exist in the Ganga valley at that time ? On the other hand, the occurrence of painted Black-and-Red Ware at many places in the Ganga valley and east as at Sravasti, Sohagaura etc., would seem to show that there was no cultural vacuum before the advent of the Painted Grey Ware in the Gangetic basin. At any rate, the collapse of the Harappan fabric of city-states into a series of disparate copper-using communities, each fending for itslelf, would seem to be clear. Can it be likely that, with the end of the agriculturally prosperous Harappan empire (where technological specialists could be adequately subsidised by the overlords with the overflowing agricultural produce,

stored up in huge granaries), the specialists in coppercraft were left without proper patrons or without consumer potential, and this resulted in their migrating from the impoverished and desiccated Western Indian scene toward the more virgin and less exploited tracts of the Eastern Ganga Valley? This reasoning would have at least the merit of disentangling the bearers of the pristine Harappan culture from the technologists who were the subsidised groups and thus enable us to identify the disintegration of the Harappan temporal fabric in a more practical manner without dragging the Harappan city fathers everywhere.

CONCLUDING REMARKS

A Ghosh :

I am very much satisfied with the high standard of the comments and the valuable criticism of my paper by a few delegates, particularly by Y. D. Sharma. I am also thankful to Sharma for pointing out a grievous error that had crept into my paper, namely that an anthropomorphic figure occurred in the hoard of copper objects found at Bhadarabad.

It is evident, that there is a complete consensus that the pre-Harappan culture at Kalibangan and elsewhere, particularly in north Rajasthan, should be named the 'Sothi' culture. I agree with Sharma that other pre-Harappan cultures might have gone into the make-up of the Harappa, but one has to consider which was the predominant one. The testimony of Thapar reveals that of the six groups of the Sothi pottery at Kalibangan, as many as three have sturdy fabric as the Harappan, and one of them is identical with its Harappan counterpart not only in fabric but in slip and painted designs. Also significant is Thapar's observation that the bonding of the Sothi brickwork at Kalibangan was the same as practised by the Harappans, even though the size of the bricks was different. It cannot be dismissed as accidental that the Sothi underlay the Harappan at so many sites and that the Sothi people lived together with the Harappans at Kalibangan—not only at the same site but in the same houses. Would this have been possible if two peoples were different from each other ? The Sothi people developing themselves into the Harappans thus appears to be a strong probability, for it would be otiose to imagine that some hypothetical Baluch people acquired Harappan traits and marched into the Indus Valley; no such people are till now known to exist in spite of extensive explorations in Baluchistan, past and recent.

I welcome the observations of Kennedy on the anthropological data, as they appear to provide a corrective to some recent views. On the observation relating to the survival of the Harappa culture in the Ganga valley, I have no comments to make, as the possibility of such survival has just now been raised and much further work is needed to place it on a firm basis.

NOTES

1. In the preparation of this paper I have derived valuable help from the discussions I had with my colleagues in the Archaelogical Survey of India, Sri B. B. Lal, Sri M. N. Deshpande and Dr. Y. D. Sharma; but they are not to be

held responsible for any views expressed here. My best thanks are due to Sri J. P. Joshi, Technical Assistant in the Survey, who has traced out for me bibliographical details and analogies of pottery types and has assisted me in various other ways. I also thank Sri O. P. TANDON, another Technical Assistant, whose help in the examination of the collection of pottery from different sites has been of great help.

2. FAIRSERVIS (Nov. 1961) thinks an Iranian inspiration likely. KRAMER (1964, 51) regards the Ubaidians as the creators of the Harappa.

3. FAIRSERVIS (Nov. 1961) p. 273, 18 (Kili-Ghul-Mohammad Black-on Red Slip); p. 276, 52 (Kechi-Beg Black-on Buff Slip); p. 302, 366 and 368 (Quetta Ware); p. 303, 371 (Quetta Ware); p. 306, 415 (Quetta Ware); and p. 309, 450 (Quetta Ware). Also FAIRSERVIS, (1959) p. 339, (Periano Painted); p. 386, (II Jangal coarse); p. 390, 56 and 57 (Jangal Painted Variant I); and fig, 62, 117 (Sur-Jangal III). The references have been collected for me by Sri J. P. JOSHI, who also draws my attention to the occurrence of radiating lines ending in solid, discs at Nundara, STEIN (1931), pl. XXVII, Nun 1·5, of opposed triangles at Mehi, Pl. XXIX Mehi III. 1·2 and Mehi. III 6·12, and of double row of needles pl XXIX, Mehi. II. 6·3. A more persistant search is sure to establish many more parallels.

4. According to FAIRSERVIS (1959, 335) the Wet Ware has its beginnings in Kili-Ghul-Mohammed III but continues in later periods.

5. It should be noted that the Quetta Wet Ware also occurs at Periano-Ghundai, (FAIRSERVIS, 1956, 354), which makes its travel to the Sothi easier to explain.

6. It seems that the design in question resembles FAIRSERVIS (1959, Fig. 63. 39) Sur-Jangal II.

7. WHEELER (1961, 248) refers to a marked similarity between the Early Kot-Diji and Amri Wares. Perhaps J. M. CASAL's current excavation at Amri, in which he is said to have stratified the Amri Ware, would clarify the issue.

8. 'A civilization such as that of the Indus cannot be visulised as a slow and patient growth', aptly remarks WHEELER. (1961, 248).

9. *Human skeletal Remains from Harppa* · Anthropological Survey of India, Memoir No. 9, Calcutta, 1962. The latest publication on the subject (SARKAR, 1964) could not be consulted by me before writing this paper.

10. From the maps that I have been able to consult the site appears to be situated in the Dingra Valley.

11. STEIN (1942, 173-82). A recent look at STEIN's collection from Ratta-Theri, a Bhawalpur site, available with the Archaeological Survey of India showed the presence therein of a Harappan blade. Externally ribbed ware and a painted trident design (Sothi) were seen in the same collection from Lurewala. Both the sites are known for their Cemetery H Pottery (WHEELER, 1947, 118).

12. The carbon-14 date of the middle level of Sub-period I A of Ahar, belonging to the Banas culture is, 1725± 140 B. C. Gilund, also of the same culture (*I. A. R.*, 1959-60, 41-46) is believed to have begun earlier. For this and other C-14 dates mentioned here, see LAL (1963, 208-12). The half-value life is 5730 ∓ 40 in each case.

13. To this list should be added Deheru, Manupur and Khaeri-Nudh along the course of the Budha-nala, believed to be an early bed of the Sutlej in Ludhiana District (*I. A. R.*, 1961-62) (in press).

14. RAO, (1956-57, 82-89; 1963, 178-80)
I. A. R., 1954-55, 12;
1955-56, 6-7;
1956-57, 15-16;
1957-58, 12-13;
1958-59, 13-15;
1959-60, 16-18;

15. FAIRSERVIS (1956, 357) argues for ' nearer 2200 B. C. than 2500 B. C. ' for the beginnings and ' perhaps as late as 1300 B. C. ', for the end, admitting that there is nothing more to justify the dates except the implied tendency of his analysis to make dates somewhat later.

16. LAL (1953) supplemented by a few recent determinations made by the Tata Institute of Fundamental Research.

17. The latest determination of three other samples from Lothal has not been taken into consideration as the Laboratory states that they were of charcoal powder mixed with earth and were wet-combusted, so that there exists the possibility of combination by younger carbon.

18. AGRAWAL (1964, 143) agrues for 2300 to 1750 B. C. for the life of the the Harappan culture on the basis of Carbon-14 dates. This chronology is not at great variance with that propoesd here.

19. A recent view propounded by workers in Central Asia is that while the Jhukar occupation perhaps demonstrates the advent of agricultural tribes from Baluchistan, whose culture manifests unmistakeble similarity to the Bronze Age of Iran and South Turkmenistan, the Jhangar occupation supplies material which testifies to the appearance of the Steppe tribes of Indo-European origin. ITINA (1963, III, 15-22)

20. LAL (1954-1955, 5-151). The anthroplogical data in regard to Cemetery H may be recorded here, though it is not strictly relevant. According to *Human Skeletal Remains from Harappa*, p. 179, in Cemetery H the cranial index is higher than R. 37, the people of which had longer heads and narrower faces. Within Cemetery H itself the skulls from (the later) stratum I are smaller in size and have higher nasal index than those of (the earlier) Stratum II; in both the strata a few round heads are present.

21. SAHNI (1952, 153-54). RAO (1963, 180) also ascribes the end of the Harappa at Lothal to floods in the adjacent rivers.

22. G. M. Bongar-Levin (1962) thinks that this internal decay was accompained with a struggle with incoming foreigners. (This Russian article was seen by me in an informal English translation).

23. Dr. Y. D. Sharma points out that the hoard of copper objects from Bahadarabad did not include any anthropomorphic figure. I am sorry for this serious error. For the occurrence of these figures see Lal (1951, 20-39).

24. It is likely that the ochre-coloured ware is not an industrially distinct group; its apparent fabric may be due to imperfect firing and prolonged burial in waterlogged or saline soil. This makes the core and the surface softish and liable to rub off easily.

25. Under excavation by the Muslim University, Aligarh, the pottery has been seen through the courtesy of Professor Nurul Hasan and Sri R. C. Gaur, the excavators. Last Season's excavation at Noh (District Bharatpur) is also said to have yielded an ochre-coloured ware preceding the Painted Grey Ware. Information from Dr. S. P. Srivastava.

26. M. N. Deshpande (1963) thinks that Baberu of the Baveru Jataka (Jataka No. 339 tr. Cavell, 1957, 83-4) refers to Bahrain Island and not to Babylon as is usually supposed.

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Indian Archaeology—A Review (*I. A. R.*)

RELATIONSHIP OF THE INDIAN CHALCOLITHIC CULTURES WITH WEST ASIA

B. K. THAPAR

INTRODUCTORY

Before discussing the subject in any detail, it would perhaps be worthwhile to consider the significance of certain technological developments. The revolutionary change in economy from hunting and food gathering to pastoralism and settled agriculture was one of the greatest landmarks in the history of human progress and indeed by its effects laid the foundations of civilization. The new way of life was generally more sedentary, favouring the growth of specialization. One of the technical accompaniments of this development was the invention of metallurgy, primarily based on copper and tin and its alloy bronze. This knowledge was rapid in its application and portentous in its ultimate effects in as much as it established new demands and led to the necessarity for trade in raw materials and finished products. By the catalysis of trade, therefore, the self-sufficiency of stone-using villages was virtually broken and new relationships forged between isolated regions. This change, far from being general, was confined to a few areas where conditions—soils and climate alike—were favourable. The environmental attributes largely accounted for the priority of the dry lands in attaining civilization. The arid lands stimulated discoveries affecting the physical and cultural environment of man, and with intensifying factors held out possibilities for further modifications in technology and crystalization of urban life. The revolution started in West Asia where we can trace its course from the very outset; it took place in the massif of Baluchistan. Along the flanking Indus plain, on the other hand, we are faced with a civilization already fully grown but paradoxically devoid of genesis. To seek inter-relationship between the Chalcolithic cultures of these two regions is obviously consistant with the technological development obtaining at that stage.

Geographically, a certain unity characterizes the whole region which lies roughly between 20° and 40° north parallel and 28° and 78° east meridian. Permanent rivers like the Euphrates and the Tigris, the Indus and the Great Mihran (ancient Saraswati) traverse a more or less continuous desert plateau interrupted at times by physiographic features. Both areas present vast alluvial plains bordered on the north by mountains with plateaus and valleys which sheltered a variety of hill cultures, relatively independent in their cultural milieu. The restricted water supply and the open expansive terrain demanding organized co-operative effort were together formative in the growth in each region of urbanism, political centralization and other concomitants of civilization. These conditions also explain the static quality of the early developed systems. The present paper endeavours to discuss from the Indian viewpoint the extent and nature of the inter-relationships existing between the Chalcolithic cultures of the two regions. Although the data is sadly deficient to build any convincing hypothesis, the general trends of the evidence are fairly clear.

II. THE BACKGROUND—FOLK MIGRATIONS.

An important aspect of the relationship concerns the movement of the peoples from one region to the other under economic or political impulses. In Mesopotamia, within the range of our survey, one such movement was evidenced at the beginning of the Uruk Period (protoliterate a, b and c) which was marked by the appearance of new elements : engraved seals, stamp variety giving place to cylinder in Late Uruk times; use of stone in monumental temples; sculpture in the round; writing on clay tablets in Late Uruk; superior technical devices like potter's wheel and advanced metallurgy with a knowledge of casting *cire perdue*; and a sudden change-over from the painted to the plain light-coloured wares, either red or grey. The advanced social structure ushered the urban revolution. It has been suggested that the new impulses came from the ' West-north Syria, etc.—perhaps through the infiltration of a Semitic element. The succeeding Jamdet Nasr Period (Protoliteratured) witnessed further innovations both in ceramic and glyptic styles. A new painted style emerged, mostly using plum-redr slip as a base for decoration or a 'reserved slip' technique. A notable type in the usual drab wares which continued throughout the period was a knobbed lid of a type recurring in the Indus pottery. A new artificial substance called faience was introduced for making personal ornaments. With the marked advance in script, the transition from an urban status to civilization was complete. A similar stage had reached in Susa C, Hissar I and in the later part of Sialk III. This level of cultural development formed the background of our Chalcolithic cultures of the third millennium B. C.

A second folk-migration took place around circa 2000 B. C. The painted pottery tradition was again interrupted by the appearance of plain burnished grey ware. Other finds showed similar innovations in culture traits : new type of copper and bronze tools and weapons. The arrival of new comers who are connected with the dispersion of the Indo-European speaking tribes and are mostly barbarian potentates is amply attested at Hissar II—III, Giyan III, Anau II—III Shah Tepe and Turang Tepe. These movements reflect insecurity, raiding, etc. As such the associated assemblages represent promiscuous traits. The post-Indus Chalcolithic cultures of the subcontinent arose and flourished against the background of these conditions.

III. MATERIAL EVIDENCE.

The Chalcolithic cultures of the Indo-Pak sub-continent broadly fall into four groups : (a) the peasant communities of Baluchistan, Makran and Sind;(b) the urban 'Indus' cities and their decline or eclipse; (c) the post-Indus settlement in central and western India including northern Deccan and (d) the Neolithic Chalcolithic settlements of the southern Deccan. To these may now be added the recently discovered assemblage at Pandu-rajar-dhibi, in the Ajay valley, District Burdwan in West Bengal. Chronologically, these cultures fall within the third-second millennium B. C., during which period the contemporary Chalcolithic cultures in West Asia had long passed their 'dawn' stage and were in the full maturity of their historical life.

A. The peasant communities of Baluchistan Makran and Sind.

Of the Chalcolithic phase in the Baluch hills we have enough evidence to show that towards the close of the fourth millennium B. C., the village societies had started using a wheel-thrown pottery, attractively painted with geometric and semi-realistic motifs which, besides showing cellular peculiarities betray cultural kinships with the painted pottery tradition of the Iranian Plateau. To cite examples : the painted pottery of Rana Ghundai II shows some striking similarities with that of Hissar I; the patterns of the characteristically painted Quetta Ware are comparable with those from Bakun A, Susa I, Giyan V and Sialk III; the Kulli-Mehi assemblage shows contacts with Early Dynastic Period in its Scarlet Ware analogues and again the carved steatite boxes; the files of caprid on the Kulli Ware match favourably with similar decoration on sherds from the Musyan sites; influence of Iranian painted potterry is discernible in the animal zones of Loralai II and III; Amri Ware shows its nearest analogues in Ubaidl being a descendent rather than a true contemporary of the latter culture.

From the foregoing evidence it would appear that most of the comparisons are with the Iranian facies which flourished at a time contemporary with Hissar I, Giyan V, Silak III, Susa I, Bakun A, and Anau I B. A significant exception to this generalization is, however, porvided by the Kulli assemblage which shows firm links with Elam and Sumer in the Early Dynastic Period. Whether these relations anticipated the subsequent Harappan trade-connections in the Akkadian times is a matter which falls outside the scope of this paper. Suffice it to mention that a pottery reminiscent of the Kulli culture has recently been found along with the Barbar (Bahrain) Ridged Ware from the graves at Abu Dhabi and Buraimi in the Trucial Oman in the Persian Gulf. This widespread civilization of Makran, with Kulli Ware as its diagnostic trait, may throw some light on the geographical localization of the lands-Dilmun, Magan, (Makkan) Meluhha—mentioned in the cuneiform documents.

As to the origin of the painted pottery in the recondite valley, it has been suggested that the invasion of the Proto-Elamites from Susa and of a people with Anatolian connections provided the necessary stimulus for an eastward migration of the peasant farmers of the Iranian plateau who brought with them the potter's wheel and the artistic taste of their ceramic tradition. Since an elaborate re-analysis of the material cannot be attempted here, the comparative chronology worked out by McCown has been adopted in this paper. The ceramic divisions into buff ware and red ware provinces as advanced by McCown and later adopted by Piggott, however, need re-investigation in the light of more recent work.

B. The urban 'Indus' cities and their decline or eclipse.

The West Asian contacts of the Indus Civilization have been too often documented; a barest summary must suffice here. The comparisons vary from absolute identity as in the case of seals to subjective interpretation of some similiarities in art motifs. The ascribed date of this civilization is itself derived from such contacts. Recent attempts on the basis of C-14 determinations have, however, narrowed the bracket from either end.

Until recently, the mechanism of trade with West Asia was demonstrated by the occurrence of seals of Indian type or origin and the distinctive hut urns (pyxis) in the proto-historic cities of Mesopotamia and Elam. Besides, bone inlays of the characteristic Indus kidney shape, segmented, etched and gold disk beads bronze amulets of couchants bulls, pins with animal and spiral head, bun ingots of bronze, cubical chert weights, the occurrence of a humped bull on the Early Dynastic Scarlet Ware and on a steatite vase of the same period, the pottery bearing knobs, *en barbotine*, etc., provide further evidence of parallelism and commercial traffic with West Asia. This link, howsoever tenuous, has of late been strengthened by the Danish excavations in the island of Bahrain where button seals, described as 'Persian Gulf seals,' though variants of the Indus pattern provide an evidence for an entrepot for a cosmopolitan trade between India and Sumer. Consistent with this hypothesis is the discovery of an exactly similar seal at Lothal, situated on the coastal flats at the head of the Gulf of Cambay. The impressive dockyard at Lothal is a witness to this flourishing seaborne trade. In regard to racial kinship, the skeletal remains exposed at the Indus cities were found to include the Mediterranean, approximating to the Sumerian type and the brachycephalic Alpine or Armenoid types, represented at Kish in Akkad. Furthermore, some of the statuettes recovered (as a result of illicit digging) from Mohenjodaro closely resemble the standardized 'Gudea' type.'

The above comparisons point to a general relationship, direct or indirect, between India, Elam and Mesopotamia. For the other West Asian contacts of this civilization, reference may be made to the postulated links with Minoan Crete. Of these, correspondence of the tradition of mother goddess between the Harappan and the West Asian types, more particularly the Syrio-Cretan, is noteworthy. The marked associations of the latter types showing doves, snakes and tree worship, etc., can be met at Harappa and Mohenjo-daro. Besides, traces of faint indirect contacts are also seen by some scholars in the repetition pattern on the Harappan pottery, ornamental forms like crosses, swastikas, kidney shapes, etc., animals with multiple heads and in the preference for the bull-cults.

Against this background, the divergent pottery traditions in either region present an archaeological paradox. The Indus pottery as recently remarked, 'helps rather to isolate the Indus Civilization than to link it up with other cultures'. The pottery of the Early Dyanstic, the Proto-imperial, the Sargonid, Isin-Larsa and the Old Babylonian periods in Mesopotamia, to which the seals and other knick-knacks from the Indus region belong, is quite unlike that of the Indus valley. Correspondence between the ceramics of the two regions is confined to : (a) lids with central knobs (b) cylindrical goblets (c) pots with overall knobbed decoration and (d) use of 'reserved slip' and as such does not seem to be of much significance. Again, the Barbar (Bharain) Ridged Ware is completely absent on any of the Indian sites though present at contemporary Ur. The tools and armoury of the Indus civilization also show absence of Sumerian influence. Filigree work, so popular in Sumer, was not much in evidence in the Indus cities. To crown all, the as yet undeciphered Indus script has no likeness to offer with the cuneiform or other scripts of West Asia.

For the final phase of the Indus Civilization too, West Asian influences came into play. It is widely known that in the first quarter of the second millennium B. C. there was a general break-up of Western Asiatic Civilization following migration of peoples. The peroid variously labelled ' The time of Troubles ' and 'The Peroid of Invasions ' saw the rise of the Hittite Empire in Asia Minor. In Mesopotamia, the Guti tribes, rudely if not ruthlessly, shook the Kingdom of Akkad. Archaeological evidence of folk movement is also attested to at Hissar, Turang Tepe, Shah Tepe, Giyan and Anau, where new types of tools and weapons appeared and the painted pottery was supplanted by a plain burnished grey or black ware.

The emergence of these nomadic or semi-nomadic tribes had corresponping effects on the settlements in the Baluch hills. A witness to this invasion are the Shahi Tump graves furnished in an alien tradition. The bodies were accompanied by flat axes including the shaft-hole axe, single-blade knife of copper, compartmented copper stamp seals, alabaster bowls, and exotic pottery. While the pottery seems to be a late and decadent version of the ceramic tradition of Susa I and Bakun A, the shaft-hole axe and the compartmented seal reflect exact parallels at Hissar II B and III, Anau III and Susa I, and a little later at Byblos in Syria and in Central Anatolia. The Jhukar settlement at Chanhudaro also documents an alien tradition as represented by stamp seals including one compartmented, precisely comparable with that from Shahi Tump, ornamented beads and a copper shaft-hole axe. The pottery, however, is of an indigenous type combining a variety of elements from Baluch sites but including isolated motifs which can be traced further west. The occurrence in a late stratum of Mohenjo-daro of a copper axe-adze with a shaft-tube, characteristic of a number of sites in notrh Persia such as Hissar III, Shah Tepe, Turang-Tepe, and swords with strengthening mid-rib, familiar in Palestine in Hyksos period, also imply arrival of newcomers. At Harappa, similar evidence is afforded by the large Cemetery H dug into the debris overlying the Harappan cemetery. The pottery associated with the intrusive Cemetery H is essentially without any parallel in any of the known cultures, though, in the treatment of some motifs ancient Iranian or north Mesopotamian strains may be detected. Besides, such scattered finds as the copper ' trunnion-celt ' from Kurram, the bronze sword from Rajanpur in Punjab as also those from Fatehgarh and Kallur, suggesting western contacts respectively with Hissar III, Anau III and Luristan and Caucasus are reflections of the same evidence.

C. The Post-Indus settlement in central and western India including northern Deccan.

The post-Indus Chalcolithic cultures in central and western India in their present manifestation pose problems of origin and mutation. These do not show, save for occasional patterns on pottery and some recurrent forms, any clear link with the Indus Civilization. What happened to the Indus script or [to the fully developed urban civilization are questions which remain unresolved. During

the last decade or so nearly a dozen sites belonging to this complex have been trenched in the region and three principal cultures determined (a) the Banas Culture; (b) the Central Indian Chalcolithic Culture and (c) the Northern Deccan Chalcolithic Culture. All of these, while differing in their ceramic traditions share a common level of food economy and technology.

The Banas Culture, characterized by its white-painted black-and-red ware, is chronologically earlier than the remaining two, being assignable to circa 1800-1200 B. C. Recent excavations at Ahar, the type site of the culture, have provided material evidence of new links between Western Asia and India. The pedestalled grey ware bowl, the unique chandelier-like dish-on-stand and animal handled lids show affinities with similar vessels from Hissar, Shah Tepe and Geoy Tepe in Iran and Troy. Significant correspondence, however, is provided by the decorated terracotta spindle whorls, closely resembling those from Troy II and Anau.

The Central Indian Chalcolithic Culture, dated to circa 1700-1000 B. C., also shows contacts, though by no means consistent with West Asia. At Navdatoli, the principal site of this culture, the occurrence of dancing human figures on a white-slipped pottery, channel-and pinched-spouted bowls, pedestalled champagne or brandy cups, narrow-necked vessels with dish-like top and round bowls decorated with hollow circles filled with dots attest to this correspondence. Besides, some painted motifs–human, animal, bird or geometric–have also echoes in the Iranian sites. Coming to details the channel-spouted bowls show closest similarity with corresponding forms from Necropole B of Sialk and Tepe Giyan I; pedestalled bowls have analogues at Hissar III; the round bowls decorated with hollow circles filled with dots are paralleled at Carchemish in the 'champagne grave strata, 'ascribable to the early Hittite period'.

The Northern Deccan Chalcolithic Culture characterized by the Jorwe Ware and assignable to circa 1500—1000 B. C. does not show any contacts with West Asia save for the dagger with a faint mid-rib from Chandoli and a fragment of a bronze dagger with raised mid-rib from Phase III of Navdatoli. I may add here the theriomorphic pot (bull) from Chandoli which has parallels (in concept only) in the early Dynastic and later periods.

A new link with the Minoan Civilization of Crete has recently been postulated on the basis of some pottery and other relics including a stone seal found from the excavation at Pandu-rajar-dhibi in West Bengal. In the absence of any confirmatory evidence obtained under closely observed condition not much reliance need be put on these finds.

D. The Neolithic–Chalcolithic settlements of the Deccan.

The Neolithic-Chalcolithic settlements of the Deccan, belong to the Southern Neolithic Culture complex dated to circa 2000-650 B. C. (or somewhat later, taking the Brahmagiri evidence into consideration). The assemblage does not present any direct link with West Asia. Nevertheless, it is argued that the burnished grey ware, being a distinctive trait of this culture, is inspired by the grey ware complex associated with the folk-movements from the Turkomam steppe

north of the Elburz Mountain towards the close of the third millennium B. C. The similarity of potting technique has been taken to be a culture contact between India and West Asia.

E. Blade Industry.

Lastly, the technique of making blades or ribbon flakes with crested-guiding-ridge, characteristic of the whole range of Chalcolithic cultures in India, is itself an adaptation from West Asia, having originated in the Jericho region and transmitted through settlements in the Fertile Crescent and the Iranian plateau to the Indian Chalcolithic (Bronze Age) Culture.

IV. OBSERVATIONS

From the foregoing evidence it is apparent that the Chalcolithic cultures in India did not exist in complete isolation of their contemporaries in West Asia. Lest the unwary diffusionist holds his ground, it must be stated that at no stage was the evidence for inter-connection reasonably consistent or impressive in bulk to imply a full-scale migration. In the present state of our knowledge we can say that India is indebted to the Near Eastern focus for some of the generalized or specific traits. Certain common ideas were transmitted into different environments which resulted into a complex of cultures with varying milieu and yet related to each other by generalized or specific traits. WHEELER has aptly suggested that ideas have wings.

Coming to the Indus Civilization, we find that analogies between the Indus and the Mesopotamian civilizations are only of a general kind, being largly abstract. The two civilizations had a continuous trade relationship which did not materially affect the social apparatus or the pattern of the cultures in each region. Both of them converge on a common background based on cultural development of agricultural communities. Even with the similarity of socio-economic conditions, the political life in both the civilizations developed on different patterns. Mesopotamia with its much earlier tradition of civic life cannot be considered as standing in parental relation to the Indus Civilization. The explicitly Indian character of the latter remains unimpeachable.

With the post-Indus Chalcolithic cultures we find that the tradition of literacy had disappeared and organized civic character of the culture forgotton. It is quite possible that technical tradition was carried over and with impulses from West new assemblages were formed. Now to the analogies; the channel-spouted bowls occurring in Phases III and IV at Navdatoli are matched with those from Necropole B at Sialk and Tepe Giyan I, both assignable to circa 1000-800 B. C. On the basis of C-14 determinations, Phases III and IV at Navdatoli cannot be dated later than 1200 B. C. What is more significant, however, is the association of iron and grey ware of Hissar III—Anau III complex in the assemblages represented in Necropole B and Tepe Giyan I, both traits being completely absent in the Central Indian or Northern Deccan Chalcolithic cultures. This precludes any direct influence, not to speak of import. The analogies of other forms including the decoration of the dancing figures are of a general kind, the family resemblance in the latter case being spread over disparate horizons.

Besides, the distances between the sites render such comparison as of uncertain significance. How far these postulated links are connected with the folk movements in the second millennium B. C. cannot be decided from the limited material. The white-painted black-and-red ware of the Banas Culture is contrary to any prevailing or earlier ceramic fashion in West Asia. The links postulated above, through typological correspondence of certain pot-forms and decorated spindle whorls, are again only implicit. The diffusion of the grey ware potting technique from the Iranian plateau to Deccan cannot be properly explained, the culture-traits of each area and the time-scale largely remaining un-coordinated. The concept of ' idea with wings ' may offer a reasonable explanation for such apparent inconsistencies. Opportunities for the transfer of the ideas undoubtedly existed. With the available evidence we seem to have reached an impasse in our knowledge. More stratigraphic evidence notably from the intermediate regions is necessary. Meanwhile it may be remembered that the diffusionary impulses would not move into cultural vacuums.

COMMENTS

Z. D. Ansari :

It has already been shown that some pottery shapes from the Chalcolithic strata at Navdatoli have close affinity with those of Sialk in Iran (SANKATIA, 1956). Harappan relationship with Iran and Mesopotamia has also been established on the basis of painted designs on the pottery of the two regions (STARR, 1941). While studying the Chalcolithic painted pottery from Navdatoli and Nevasa, it was noticed that besides the idea of depicting dancing human figures from Navdatoli (SANKALIA, 1955 a) and antelope motif from Nevasa (ANSARI, 1957), which have been compared with West Asia, there are some painted designs which have parallels in Baluchistan and Iran, the comparison being confined to the elements or units used in the composition of the designs; rarely does an entire design find its parallel. It must be admitted that in this comparative study, the pigment, the colour and the treatment of the pot-surface have not been taken into account.

The designs from Navdatoli, Nevasa and Jorwe which have been compared with Baluchistan and West Asia fall into two groups :

1. Horizontal bands of single or multiple decorative elements, bordered or separated by a single or a group of straight horizontal lines.
2. Space fillers of different elements.

The decorative elements used on Navdatoli and the Northern Deccan Chalcolithic pottery which can very well be compared with those from Baluchistan and Iran (Sialk) are as follows : (i) horizontal zigzag lines; (ii) horizontal wavy lines; (iii) vertical straight lines; (iv) vertical wavy lines; (v) slanting straight lines; (vi) slanting wavy lines; (vii) palm leaf; (viii) lattice; (ix) triangles; (x) loopes; (xi) diamonds; (xii) axe design; (xiii) dots; (xiv) circles; (xv) animals; (xvi) sigmas; and (xvii) plants.

N. R. Banerjee :

As the connection between the urban Indus cities and the post-Indus settlements, the stratigraphy shows a post-Harappan horizon with little or no stratigraphical overlap, though a little influence in pot-shapes as a thin survival is discernible. The radiocarbon dates also point to almost mutual exclusiveness. Regardless of the geographical overlap, the two clutures are for the major part unconnected, as the material cultures would emphasize.

In view of the chronological considerations, there cannot be any question of a substantial influence from Sialk VI B, as it is controversially dated to 1200-1000 or 1000–800 B. C. The total absence of iron from the Chalcolithic cultures of Central India and the Deccan is another important factor to be considered in this context.

As regards the theory suggested in some quarters about the Chalcolithic people being possibly of Aryan stock, the present evidence, though limited, of brachycephalic and Australoid elements together would be counter-indications. The geographical location of these cultures is at variance with the habitat of the Aryans as suggested by the ṚIGVEDA. The absence of the horse in any form, including pictorial representation, is no less important. I would agree with THAPAR in attributing some of the parallels to the inexplicable phenomenon of Idea.

It is also to be considered that a suggestion has been made that the 'Copper Hoards' of the Ganga plains form an integral element of the Chalcolithic cultures of Western and Central India. The comparative rarity of such objects in the Chalcolithic complex, and the rarity of Chalcolithic sites in the northern plains despite the limited evidence of Chirand, Kumauli or of Pandu-rajar-dhibi would make it difficult to concede the suggested connexion. The absence of this connexion will preclude a contact with West Asia, as some of the tool types have sometimes been questionably traced to West Asia.

M. K. Dhavalikar :

Curious objects of ivory, resembling stylized human figurines, are usually found in the Northern Black Polished Ware levels (circa 500–200 B. C.) at many sites in Northern and central India. They bear incised linear patterns inset with the typical 'eye' motif. Till now, such figurines were confined to the early historical period only. But with the discovery of similar figurines in Period I at Ujjain and in the Painted Grey Ware levels at Alamgirpur, their antiquity can further be stretched back to the end of the second millennium B. C. and the beginning of first millennium. Furthermore, it is interesting to note that these figurines appear only to be the evolved forms of their proto-types from Harappan sites. These figures bear a family resemblance to the 'eye-goddesses' in West Asia. MALLOWAN found a large number of such figurines in alabaster in a temple at Tell Brak. The Indian figurines can also, therefore, be called 'eye-goddesses'. They represent yet another link in the cultural relationship between India and West Asia.

H. D. Sankalia :

I had written a very exhaustive paper on this subject some four years ago and it is likely to be published soon in ARTIBUS ASIE. As such I would not like to cite in detail all that I have mentioned therein

The most pertinent question is whether there has been any diffusion from Western Asia, which, as we know in our present stage of knowledge, seems to be one of the earliest cradels of civilization ? If there has been a diffusion it might have taken place in a number of ways. Either some people migrated from Western Asia or there might have been a very slow diffusion of ideas which have in course of centuries and millennia, reached some nooks and corners of India. If we do not accept or believe in the theory of diffusion, we shall have to put forth the alternative of independent origin of traits in various parts of the world. It is against such a very broad and important question that we have got to consider the evidence from Navdatoli, Nevasa, Chandoli and other sites in India.

Certain aspects like the bowl with channel-spout from Navdatoli and the wine-cups are so peculiar to what we know in India at this time that we have got to think in terms of their having been introduced through some kind of diffusion from Western Asia, particularly Iran. I would, however, not emphasize the contact with Iran alone. Channel-spouted vessels have been known in Western Asia from about 2,500 B. C., a vessel of this type (in stone) is also reported from Khirokitia in Cyprus and is assignable to about four or five millennium B. C. Such a kind of vessel might have been introduced into India either directly from Iran or from any other site or sites in Western Asia. One aspect, however, is noteworthy in this comparative study. The vessel from Navdatoli compares very well with that from Tepe Giyan, which has been dated, according to old methods, to a period between 900 and 1200 B. C., about 200 years later than Phase III at Navdatoli. C-14 dates from the comparable site of Hasanlu confirm this horizon. This aspect of chronology has been mentioned as a very serious objection against the view that the Navdatoli specimen has been derived directly from Tepe Giyan. Against this hypothesis, I would not emphasize the contact with Tepe Giyan alone. As explained above the idea might have come from any earlier site in Western Asia and not necessarily from Tepe Giyan.

About the occurrence of wine-cups I may mention that we have recovered hundreds of such cups from the earliest levels in Navdatoli. Similar cups have been noted from Rangpur III, but not from the earlier periods, implying thereby that they were absent from the Harappan levels. Now we have got to examine this question from a very broad point of view. We have been using wine-cups in India after they have been introduced once by the Persians in about thirteenth-fourteenth century and later by the Europeans. They are now being used both for wine as well as for ice-cream. Otherwise such cups have been totally absent in the period between 1000 B. C. and A. D. 1200. It is arguable, therefore, that whenever there have been contacts with Western Asia and particularly Iran, such cups have been found to be in use in India. If we examine the evidence from Navdatoli in such a light, the conclusion is inescapable that such cups have been

introduced by a people who were accustomed to a kind of life in which these cups were of daily use. It is no doubt agreed that the fabric of both the channel-spouted vessels as well as of the wine-cups from Navdatoli is quite different from those of corresponding examples found in Iran or any other site in Western Asia, and that vast areas separated the two regions. It has not been possible, therefore, to trace the various links by which these pots or ideas could have travelled to India.

Lastly, I would mention the theriomorphic (bull like) vases from Navdatoli and Chandoli which compare very well with similar vessels from Sialk. When one such vase was shown to MALLOWAN he was greatly struck by the close correspondence in its shape with those from Iran and affirmed that the shape seems to have been directly borrowed from Iran and Western Asia.

R. C. Gaur :

THAPAR has sub-divided the Chalcolithic cultures of the Indo-Pak sub-continent broadly into five groups. The classification is in general acceptable. But with regard to his groups (b) and (c), some comments, however, may not be out of place. THAPAR probably includes in group (b) the culture represented by the Ochre Coloured Pottery as well. GHOSH and others are also inclined to consider this culture on the whole as the last survival of the Indus Civilization. But whereas a site such as Ambkheri, District Sahranpur, recently excavated by DESHPANDE, may belong to the Harappan group, other sites, where 'Copper Hoards' have been discovered (though not during proper excavations), as also Atranjikhera seem to belong to an altogether different cultural group. Recently, quite a thick deposit of Ochre Coloured Pottery has been found at Atranjikhera. It has not been possible to establish so far a definite affinity between the finds of Ambkheri and Atranjikhera. While many pot-types at Ambkheri appear to have Harappan affinities, those found at Atranjikhera bear no such trace and look different. It is true that in a few pot-types such as knobbed lids, dish-on-stand, flared rimmed vases with black painted horizontal bands on the neck part, and a few others, resemblance could be suggested, but even so the actual similarity was in each case vague and remote. This may imply some contact between the two cultures but certainly not direct affinity. One may, therefore, venture the conjecture that a separate ethnic group from Ganga-Yamuna Doab, hitherto unassociated with the Harappan culture, at some stage received influences from refugee Harappan communities moving towards the east from their principal stations.

Fortunately, Atranjikhera has provided for the first time a complete cultural sequence of the proto-historic period in the Yamuna-Ganga Doab. As soon as radio-carbon material from its Black-and-Red phase is dated, a clearer picture would emerge about the time scale. Though at this stage, nothing final can be said about it, the possibility of association between the Ochre Coloured Pottery people and the 'Copper Hoards' in the Ganga Valley cannot be ruled out,

So far as THAPAR's group (c) of the Chalcolithic culture is concerned, a new area of the Ganga-Yamuna Doab may also be added to this region. During this year's excavations at Atranjikera a new cultural assemblage represented by the Black-and-Red pottery, lying just below the Painted Grey Ware phase has been found. Though the associated pottery from this phase remains quite different from that of any other Chalcolithic site, the Black-and-Red pottery may show some affinity typologically with that found at other sites specially in Western India in Northern Deccan.

While making a comparative study of the pot shapes from different sites, THAPAR has rightly observed : ' All of these while differing in their ceramic traditions share a common level of food economy and technology '. Inspite of these similarities, the differences between the regional groups including those of Western Asia are quite marked. This leads one to agree with THAPAR's opinion that on the one hand the post-Harappan cultures must have drawn inspitration from some common Near Eastern focus, and on the other, the common external influences were modified quite substantially in different environments, so that the unity existed only in diversity.

V. N. Misra :

ANSARI has shown the close similarity that exists between the geometrical designs on the Indian Chalcolithic pottery and those occurring on pottery from certain sites in West Asia. Though the comparison of such designs does indicate the possibility of their introduction into India from West Asia because of their chronological priority in the latter region, it does not help us much in extablishing specific cultural correlations. The designs in question are too generalized. I, on the other hand, feel that we should look for similarity in specialised and uncommon designs such as the dancing human figures from Navdatoli and the animal design from Daimabad, for both of which SANKALIA has pointed out close West Asian parallels.

While the question of Harappan chronology was being discussed AGRAWAL on the basis of C-14 dates suggested 2300 B. C. as the lower limit for the Harappa Civilization. The evidence of contacts between the Indus Valley and Mesopotamia however, points out to a fairly early date. WHEEHER had favoured the date of circa 2500 B. C. for the beginning of the Harappa Civilization. But MALLOWAN and GORDON thought, after a ciritical consideration of the available material, that a date of a century or so earlier would fit the evidence better. Both of them have laid particular emphasis on the common link of the chracteristic stone vases, which are known to occur at a number of Mesopotamian sites as far north as the Diyala region in Early Dynastic III contexts as also at Mohenjodaro. Thus, any consideration of Chalcolithic chronology should take into account cultural factors besides C-14 dates.

THAPAR has raised the very pertinent question of what happened to the Harappan script after the end of the Harappa Civilization. The explanation for this does not seem to be very difficult. Script has a specific function to perform

and appears in early civilizations only when society has acquired a particular level of economic and civic complexity, in other words in the urban stage. Even in the Indus Civilization hardly any script-bearing seals occur in the contemporary village settlements, for they had no use for script. Similarly, the cultures which succeeded the highly organized and advanced Harappa Civilization were economically in the Neolithic stage, characterized by village settlements. They had a simple economic and social organization and as such had hardly any use for script. Thus we have to assume that literacy and script must have been lost a generation or two after the disorganization of the Harappa Civilization and they did not reappear until India had entered a second phase of urbanization.

Another question which had been asked is that if certain pottery forms such as channel-spouted bowl and wine-cup were introduced into India from Tepe Hissar or Tepe Giyan why was not the more useful trait of iron also adopted. It is difficult to answer this question, nevertheless it may be stated that similar instances of selective borrowing have occurred in earlier times as well. For instance, despite of the close contacts between the Indus Valley and Mesopotamia, the shaft-hole axe known in the latter region was not introduced into India. Further, in the present state of our incomplete exploration, it is difficult to say that a certain trait, say, the channel-spouted bowl was introduced into India from a specific site in Iran and Iraq. It is quite likely that the trait at both the sites may be derived from a third source which has not yet come to light. After all it is largely a matter of accident that certain sites have been discovered and excavated. Until systematic and thorough exploration and excavation have brought all ancient sites in the pertinent regions to light, we cannot say with certainty that any particular trait has been borrowed from a specific site. However, as far as the channel-spouted bowl is concerned, we now know that its proto-type (in stone) was known from the middle of the sixth millennium B. C., in the Near East as shown by similar examples from the Neolithic cultures of Khirokitia in Cyprus.

SANKALIA has already pointed out the significance of the study of cultivated grains in this context. We have to see if the earliest grains cultivated in India are indigenous or foreign, and in case of the latter, to work out the route and history of their dispersal into India. The grains found at Navadtoli point to West Asia as the source of their origin.

Finally about independent origins. It has been asked by several scholars here that why should we look for diffusion only to explain the presence of certain traits in India which are also common to West Asia. They could have independently originated here. For one thing, independent origins are not so common as they are sometimes thought to be. Secondly, the methodology of culture history requires that to explain the presence of any culture trait in a given place or area, we must first look to neighbouring regions for its parallels in time and space. Only when all possibilities of its derivation from any other source have been exhausted, we should postulate an independent origin. If culture histories of different regions are studied in isolation, far too many traits would appear to have originated independently.

S. P. Gupta :

With a view to understanding the traits detailed by SANKALIA, ANSARI and others which have been taken as indicative of Iranian influence or import in India, I visited Sialk and later also the Teheran Museum to see the excavated material. From comparative study I could say that the channel-spouted vases from Sialk have not only considerably longer channels but in addition have curved handles. I feel that we cannot isolate this feature of the spout for purposes of comparison. If it was really a case of import or even influence or imitation, probably a highly utilitarian part like the handle would also had been kept or imitated as the case might be. About the painted designs, somehow, I have a different feeling. Many of the similar designs are available on the Neolithic Chinese pottery which I saw displayed in the museums at Stockholm. In fact, at one time Chinese scholars also took them as Iranian imports. Likewise, some similarity between the Indian and the Mexican art traditions has been taken by some scholars as exports from India. Dr. Grace MORLEY, who has a first-hand knowledge of both the Indian and Mexican materials, tells me that such a parallelism is not so real as to indicate any relationship of give and take between the two countries. It is not, therefore, a case of diffusion. It also seems to be quite plausible that at a certain stage of cultural development, men from different places express almost in the same fashion without being much influenced by their contemporaries or neighbours. Probably, during the third and second millennia B. C., many communitites were changing fast from a nomadic life to a thoroughly settled life with the result that a process of division and specialization of labour started emerging in their communical life. It gave leisure and opportunity to men of aesthetic sense to develop art. Painting on earthen pots was the simplest method of this expression. No doubt, art expressions will differ not only from community to community but also from region to region and age to age. Yet, there are certain definite stages through which an art-tradition of any given community develops. Thus in early stages the approach is realistic and is for particular forms or designs. In the case of the former and of many linear and dotted patterns similarities may just be natural and accidental. A dish at Sialk from Neoropolis ' B ' has arrow-designs in circle, executed in a ' blotting-paper ' manner and reminds one of a similar dish in 'Cemetery H'. It is just accidental. Men with upright flowing hair is equally characteristic of ' Cemetery H ' and some West Asiatic culturns and as such may be equally accidental, a product of thinking in the same direction. Unless definite individualistic forms are also met with re-inforced by other evidences of contacts, I would very much hesitate to accept any theory of diffusion, particularly when the controversial questions of Iranians and Aryans are brought in.

S. R. Rao :

The knick-knacks exchanged between the Indus and the Mesopotamian civilizations often listed by scholars and now mentioned again by THAPAR with a few additions from Lothal provide evidence for international trade.

GADD has listed as many as eighteen seals of the Indus type occurring at Ur, the chronological value of which WHEELER has examined in his *The Indus Civilization*. The majority of the seals are circular, bearing the Indus motif or script or both on the obverse and a large perforated knob with triple grooves and four circlets on the reverse. They resemble very closely the circular steatite seals from the Bahrain island recovered by the Danish Expedition. One such seal was found at Lothal, too. The circular seals from Ur resembles more the Persian Gulf seals than the square seals of the Indus Valley (RAO, 1963 a). The Indian merchants living in Bahrain and trading with the Sumerian cities must have got Indus motifs and script engraved on the circular type of seals which were in vogue in that region. Hence we may call the circular seals of Ur as Bahrain seals of Indian merchants, emphasizing thus, the maritime aspect of the Indus trade.

As a result of the sea-borne trade, the coastal towns of Gujarat felt the impact of the Western Asistic civilizations to a greater degree than the hinter-land Indus cities themselves. One of the results of this impact is the development of the provincial style of painting at Lothal, characterized by the depiction of animals in their natural environment and the introduction of birds and vegetable motifs RAO, 1963 b). These features are reminiscent of the Elamite style. The terracotta female figurines from Lothal bear resemblance to those from Kulli and Diyala. The apparent divergence in the pottery traditions of the Indus Valley and Western Asia may be said to have been partly explained by the ceramic traditions of Gujarat where both the provincial and the classical Indus style were in vogue. The joint burial system, unknown in the Indus Valley, may be the result of the cultural contacts Lothal had with Ur, and other Sumerian cities. Thus, it is event that unlike the inland cities which remained isolated the coastal towns of the Indus Civilization were to some extent influenced culturally by West Asian traditions.

Among the post-Indus cultures, the Central Indian Chalcolithic (Malwa) culture, represented by Navdatoli, is said to have been greatly influenced by West Asian cultures. The ceramic forms such as the pedestalled bowls or wine-cups, the channel-spouted vessels and some of the painted motifs have their parallels in the Iranian sites especially Sialk, Necropole B, Tepe Giyan I, and Hissar III. THAPAR has pointed out that, in point of time, phases III and IV of Navdatoli, when the Iranian influence is said to have been the greatest, cannot be dated later than circa 1200 B. C. whereas the Iranian parallels (Sialk B and Giyan I) are assignable to 1000—800 B. C. On the other hand it has been convincingly demonstrated at Rangpur how the pedestalled bowls (wine-cups) are evolved from the Harappan bowls and dishes-on-stand in three stages (RAO, 1963 b, 63, fig. 17) At Ahar, too, the intermediate stages of the large bowls with stand have been found. It is, therefore, not necessary to look to any foreign influence to understand the emergence of the wine-cup. Similarly, the spouted vessels need not have come from West Asia, as the Harappans already knew how to make spouts. It is necessary to remember that the spouted vessels of Giyan, Sialk, and Hissar also have handles which are conspicuous by their absence in Navdatoli and Nevasa. Iron and grey ware commonly known in ANAU III and Hissar III are also absent in the Chalcolithic cultures of the Deccan and Çentral India. The distance between

Iran and Central India and the lack of other essential features of Iranian cultures in the Indian Chalcolithic assemblages are factors which should be taken note of before postulating any theory of folk migration from Iran to Central India. The possibility of copying a few motifs or exchanging some knick-knacks in the course of trade, more by a sea route than by a land-route, may be ruled out.

Reply by B. K. Thapar :

The comments offered by the various scholars have evoked great interest, especially in regard to the principle of diffusion vis-a-vis the uniformity of nature. These have been fully discussed, and there is very little for me to reply except, however, a few points raised by ANSARI, GAUR, and MISRA.

About the comparative study of certain painted motifs, brought to light by ANSARI, it may be pointed out that there are many pitfalls in studying a single element without considering the different complexes of which it may be a part. Furthermore, it may be remembered that the syntax of the painting styles or the decorative theme is often related to the forms. Some of the designs are zonal or tectonic in the sense that the structure of the vase is emphasized while others use the whole vase as a free field. For a fruitful comparison, therefore, both the graphic and the plastic media should be taken into consideration, in addition to the techniques of painting including the colour scheme of the pigment and the surface, etc. Secondly, besides looking for similarities in specialized and uncommon designs as stressed by MISRA, we should study the design-elements also from a chronological point of view. Not much useful purpose will be served by comparing designs of chronologically disparate cultures.

In regard to GAUR's remarks about the place of the north Indian cultures of the interregnum after the fall of the Indus Civilization, represented respectively by the Ochre Coloured Pottery and the pre-iron Black-and-Red ware, I may mention that at the present moment evidence for the constituent elements of the cultures represented by these wares is sadly insufficient. Indeed, we have no tangible grounds for affirming positively whether these cultures were definitely Chalcolithic on the technological plane. Nevertheless, on the evidence obtained from such sites as Atranjikhera, Rajghat, Sonpur, Chirand, and Prahaladpur, the existence in the northern plains of a distinct cultural horizon prior to the emergence of iron, has to be recognized. This relates largely to the strata yielding the Black-and-Red ware. The culture represented by the Ochre Coloured Pottery still remains elusive. The evidence regarding its association with the notorious 'Copper Hoards' is more indicative than conclusive. Since the paper under discussion deals with the relationship of the Chalcolithic cultures with West Asia, I had preferred to omit them from my purview.

While commenting upon the introduction of channel-spouted vases from Tepe Giyan, etc., MISRA, has referred to selective borrowing. While one could agree with the generalized concept that many traits are not passed on at all, being lost at the start because of being unacceptable to some individuals, it would be difficult to convince ourselves if a utile metal like iron could be found unacceptable

when pottery forms were freely borrowed. Pedestalled bowls known as wine-cups were found at Navadatoli from the earliest Phase while channel-spouted vases started appearing from phase III. The two forms, therefore, came separately. Similar is the case of theriomorphic vases referred to by SANKALIA. Since these forms are without close parallels in the contemporary Indian ceramics, it is reasonable to look to the neighbouring regions for their possible source of diffusion. Both MISRA and SANKALIA have rightly concluded that in the present state of our knowledge it would be difficult to affirm whether Iran alone is the source of diffusion. In view of the difference in fabrics as also of the associated assemblages of these pots in different areas, the diffusion is only of ideas, the role of which should not to be ignored: the mechanism of diffusion, however, remains unascertained. Very often transit of ideas has wider ramifactions. It is the function of archaeology to draw proper conclusions from it. A preoccupation with material evidence should not distract us from reflecting on the human background of archaeology.

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THE IRON AGE IN INDIA

N. R. BANERJEE

INTRODUCTORY

The mastery of iron and the introduction of what may be archaeologically described as the Iron Age mark a very important stage in the technological advance of mankind. In the process of evolution iron is fairly late in its arrival, being preceded, in the field of metals, by copper and bronze, in that order.

For a considerable length of time, first copper and then bronze, reinforced and strengthened by the additions of tin as an alloy, met most of the modest needs of man. With all their malleability and ductility the comparative lack of tensile properties or hardness in them were serious handicaps. The gradual discove-y of such properties or potentialities of iron, first alone, and then with an admixture of carbon in varying quantities, made it at once a coveted and preferred metal. As a result, copper and bronze retired into the background, though by no means entirely discarded, and in their place versatile iron came increasingly to the foreground, paving the way for the ushering in of the Iron Age.

The Iron Age would, therefore, denote a period when iron plays the most dominant role in man's life. From this point of view we are still in the Iron Age. Yet it is interesting to observe that neither did iron appear in use nor assumed its dominant role simultaneously everywhere, nor even over a large part of the globe. It must also be stated that the use of the meteoric or natural iron did not mark its onset either. It was only when iron ores were extracted, smelted and forged by men deliberately into objects of daily use as a regular practice that the Iron Age can be said to have begun its course.

The problem of the Iron Age in India relates to the development of the technological processes of the manufacture of objects of iron, the date of the earliest use of iron and the initial period of its development, and, of course, the types of objects produced and used and their bearing on life in general.

Recent archaeolocial discoveries have shown that the beginnings of the Iron Age in India and its coming into its own took place during the first millennium B. C. As it would be too vast a subject to deal with the Iron Age in India, through its entire period of evolution and development, which has not yet ended, the present study will be, of necessity, confined to the early phase of the Iron Age in India during the first millennium B. C. Such evidence on technological processes of smelting, carburization, quenchin gand hardening as may have come to light during the period under review will be touched upon. The types of objects produced and used and their bearing on life in general will also be considered.

Regardless of archaeological evidence, Heinrich ZIMMER's views about the Rigvedic *ayas* (ZIMMER, 1957) standing for iron, have swayed many enthusiasts for an early date for the use of iron in ancient India. The view was sustained by GELDNER's (1957) translation of the word as iron in its different contexts. Even MONIER WILLIAMS (1960, 85) and MACDONELL and KEITH (1912) lent support to the idea.

It was M. N. BANERJEE (1927 and 1932) who insisted that there was evidence in the Rigvedic literature for the description of the very process of the smelting of iron ores, by the use of raw stones (ores) mixed with catalytic chemicals (flux), and fanned by bellows made of peacock feathers.

P. NEOGY (1914) also thought that ayas in the *Rigveda* referred to iron and traced its antiquity accordingly to the Vedic Age.

R. J. FORBES (1950, 437), a noted authority on metallurgy in antiquity, has admitted the possibility of iron being in use in India in the earliest days of the Aryans in the country.

More objectively, however, GORDON thought (1950 67) no doubt on the basis of the meagre evidence then available, that there was no material evidence of the use of iron in India or Pakistan prior to circa 250 B. C., except of course, the traces of iron in the cairn burials of Pakistan and the megaliths of South India. In 1958, he veered round to the view that it was likely "that iron, even though it may not have been plentiful, was well known in India by 450 B. C. " He was to categorical as to continue: " Not that a single object of iron has been found east of the Indus which can be dated as early as this. "

But more recently WHEELER (1959, 24; 164) has postulated that it was the Achaemenid Persians who transmitted the use of iron at the end of the 6th sentury B. C. to Northern India, and the iron work of the megaliths of South India are in turn to be traced to Northern Indian sources.

The most recent evidence of the association of the iron with the Painted Grey Ware in Northern India, and the possibility of an earlier date for the commencement of the iron using megalithic culture in South India pointed to a much earlier beginning of the use of iron in India as a whole.

LALLANJI GOPAL (*Uttar Bharati*) has taken stock of the situation and, considering both literary and archaeological evidence, has arrived at the conclusion that it was the Aryans who introduced the use of iron in India.

The present author fully endorses the view of LALLANJI GOPAL on a detailed consideration of the mass of associated archaeological evidence on the use of iron in ancient India.

ARCHAEOLOGICAL EVIDENCE OF THE EARLY USE OF IRON IN INDIA :—

A. Iron associated with the Painted Grey Ware :—

(i) General.—In North India the earliest occurrences of objects of iron or objects, proving its manufacture and use have been recently discovered at four sites, namely, Hastinapura and Alamgirpur, both in District Meerut, Kausambi

in District Allahabad, all in Uttar Pradesh, and at Ujjain, in District Ujjain, Madhya Pradesh. In all these sites iron objects occur in association with a later phase of the distinctive Painted Grey Ware ceramic. Stratigraphically the Painted Grey Ware and the associated cultural assemblage are lower and, therefore, earlier than the well-known Northern Black Polished Ware. These evidences are also the earliest in India's stratigraphy even when compared with the occurrences of iron elsewhere in India in different cultural horizons.

(ii) Hastinapura—The objects of iron found in the upper levels of the Painted Grey Ware comprise actual objects as well as slags of iron (LAL, 1955, *13*; 97; also information from B. B. LAL) suggesting local manufacture.

(iii) Alamgirpur.—The assemblage of iron objects at Alamgirpur (*I. A. R.*, 1958–59) comprises a spear-head, a barbed arrow-head, nails and pins occurring throughout the 1·37 m. thick deposit of the Painted Grey Ware.

(iv) Kausambi—Though small fragments and shapeless bits of iron were found as early as the third of the four structural periods within the first period of occupation on the site, more distinctive shapes occurred in the second period of occupation, which was associated with the Painted Grey Ware (SHARMA, 1960, 18). The apparently earlier occurrence of iron at Kausambi than at other places, does not mark a fundamental difference, as the Painted Grey Ware itself being characterized by simple painted bands of the later stages, is later in emergence at Kausambi than at Hastinapura.

(v) Ujjain—At Ujjain objects of iron comprising spear-heads, arrow-heads, and knives occur in the earliest period of occupation called Period I (*I. A. R.*, 1956-57, 20-28; 1957–58, 32–36; BANERJEE, 1959, 78.) This period is characterized by ceramic types associated with he Painted Grey Ware namely, incurved bowls with inclosing rims, a mat-impressed red ceramic ware, dishes and bowls of a sturdy red ware of smooth texture with a smoked slip or painting in black such as occurs frequently at Ahichchhatra with the Painted Grey Ware. The deposits of Period I are stratigraphically below the succeeding deposits characterized by the N. B. P. Ware and its associated types. Sherds of the Painted Grey Ware occur limitedly in these deposits, as well as in the make-up of the mud rampart built within the earliest period of occupation on the site.

B. Iron in the Megalithic Burials of South India.

The repertoire of iron objects found in the megaliths of South India displays a wide variety, and comprises knives, often tanged, daggers, usually tanged, wedge-shaped blades, barbed arrow-heads, spears or lances with flat elongated blades and round shafts, constricted at the butt and ending in a terminal knob, or leaf shaped with a socket base, javelins, axes, with a detached ring round the butt, featureless bars, swords with double edges and midrib, often with a hilt, adzes, sickles, hooks, horse-bits, chisels, ferrules, hatchets with single or double diagonal straps, bangles, nails, frying pans, ladles with a long handle, and tripod stands to support vessels. These objects meet most of the needs of warfare and hunt as well as of the household or agriculture and suggest a uniformity of cultural life over the extensive peninsular expanse of South India.

C. Iron in the post-Chalcolithic and Pre-N. B. P. Ware levels in West-Central India.

(i) Nagda—The occurrence of iron objects in Period II, dated by the author to circa 750-500 B. C., at Nagda, in District Ujjain, Madhya Pradesh, in a context which is a continuation of the earlier Chalcolithic tenor of life on the site, is another new evidence on an early date of iron in India. These comprise fifty-nine objects consisting of a dagger with double edges and a tapering point, a circular socket of a broken axe, a spoon, a celt with a broad cutting edge, a ring, a nail, arrow-heads with biconical cross-section and a tang, respectively, spear, heads with square or oval cross section and knife blades displaying a wide variety of shape suggesting diverse uses, and blades and sickels (*I. A. R.*, 1955–56, 12). All these indicate a fairly established usage of iron objects.

(ii) Prakash—This evidence is supported further by the evidence of well-defined objects of iron at Prakash in District West Khandesh, Maharashtra, below the N. B. P. level upto a depth of 4·27m. The objects comprise tanged arrow-heads, axes, knife-blades, fragments of a sickle, nails and clamps (*I. A. R.*, 1954-55, 13).

(iii) Bahal—Iron objects occur here in Period II (*I. A. R.*, 1960-61, 17–18) at Bahal in District East Khandesh Maharashtra, where iron is stated to have occurred some 3·05 m. below the lowest N. B. P. sherd (Wheeler, 1959, 146).

(iv) Eran—Iron objects occur here in (*I. A. R.*, 1960–61, 117–18) along with the earlier Chalcolithic tradition of the Black-and-Red ware, but below the deposits of the N. B. P. Ware, of which only one sherd has been found in the uppermost level of Period II.

D. Iron in the Cairn-Burials in Baluchistan and Persian and Baluch Makran, on the Irano-Pakistan Borderlands.

(i) General—A fairly early evidence of the occurrence of iron within the confines of the Indo-Pakistan sub-continent and the adjoining Pak-Iranian borderlands, going back to circa 800 B. C., if not still earlier is that provided by five out of twenty-seven cairn-burial sites reported by Sir Aurel Stein (1929, 1931) in Persian and Baluch Makran and Baluchistan proper.

(ii) Moghul Ghundai—(Stein, 1929, 46–47). The iron objects found inside some of the burial cairns at Moghul Ghundai comprised leaf-shaped arrow heads, arrowheads with small point, a triangular barbed arrow-head and knives and daggers, besides other objects of indeterminate use. Most of these had a tangend for hafting.

(iii) Gatti—(Stein, 1931, 75) Fragments of iron were earlier reported by Major Mockler from the Cairns at Gatti.

(iv) Jiwanri—(*Ibid.*, 79-81). A thick iron hook and scraps of iron as mentioned by Major Mockler in the eleven tombs opened by him here have been reported from the site.

(v) Nasirabad—(*Ibid*, 86) " Small pieces of iron implement " turned up in one of the cairns at Nasirabad.

(vi). Zangian—(*Ibid.*, 88) Fragments of iron, a broken large sword blade, and an iron weapon with a bronze fastening have been reported from Zangian.

(vii) General Observations. Thus the principal recongizable form of the iron objects in the cairns is the arrow-head and, rarely, the domestic knife. Among the arrow-heads the trilobate or triangular barbed one from Moghul Ghundai (STEIN, 1929, 47, XII, XIII) deserves special mention as it has parallels at Nad-i-Ali in Afghan Sistan. All these are provided with a tang for hafting on to a shaft or handle respectively.

A correlation of this apparently disjointed but well defined volume of evidence will be attempted in the following pages to work out a connected and, as far as possible, continuous picture of the early Iron Age India.

3. Chronology and the Sources of Different Cultural Landmarks Associated with Iron and their Bearing on the Evolution of Iron in India.

A. The Painted Grey Ware.

(i) General.—Though discovered earlier in the excavations of Ahichchhatra in 1940–44, the real importance of the ware came to be established after the excavations of Hastinapura in 1950–51 and the associated explorations in the Ganga plains. B. B. LAL dated it to circa 1100–800 B. C. at Hastinapura on the ground that it occurred below the deposits of the N. B. P. Ware and that it was separated from the latter by a hiatus, there being no evidence of any overlap of cultures. The N. B. P. Ware itself was dated by LAL to circa 600–200 B. C., on the evidence of its occurrence upto a depth of 4 m. below the coins of Alexander, in mint condition, discovered at Taxila on the one hand, and its being surmounted by deposits of Mitra coins on the other, ascribable to circa 200 B. C. Moreover, the cultural ensemble of the N. B. P. Ware as it presented itself at Hastinapura marked a total change from the previous cultural phase. A period of 200 years was, therefore, conceded for this development. Besides there was a significant fact that Hastinapura was washed away by a flood during the rule of Nicakṣu (PARGITER, 1962 a) the fifth king in the line of the successors of the Pandavas, as recorded in the Purnas. The archaeological evidence of flood-scar washing away a large chunk of the habitation and depositing it into the waters of the Ganga flowing by was a tempting parallelism, which was almost irresistable. The archaeological evidence of a later settlement of the Painted Grey Ware cultural ensemble at Kausambi seemed also to tally with the Puranic evidence of Nicakṣu being obliged to shift his capital to Kausambi.

The date of Nicakṣu works out to circa 800 B. C. at the assumed rate of approximately 20–18 years per reign on the basis of the Puranic eivdence of 25 kings ruling before the Nandas, who ruled a hundred years before Chandra Gupta Maurya, (PARGITER, 1962 b, 25) contemporary of Alexander the Great.

Coupled with it is the evidence of Buddhist literature showing King Udayana of Kausambi as a contemporary of the Buddha. (*Lalitavistara*, Tr. FAUCAUX, 1892; ROCKHILL, 1884; LAW, 1939, 11) Literary tradition attributes the erection of a monastery called Ghoshitārāma during the time of the Buddha to Ghoshita,

(LAW, 1939, 31) a banker in Kausambi, during the reign of Udayana, who had also married the former's daughter. Buddha is stated to have visited the monastery in the sixth year of his ministration i. e. in 563–41 (i. e. 35+6 = 522 B. C.) The discovery of a stone inscription bearing the name of Ghoshitārāma (SHARMA, 1960), helps establish the identity of the monastery, and the fact that the earliest period of its construction was during the earliest phase of the N. B. P. Ware helps to date the use of the N. B. P. Ware on the site to the time of the Buddha i. e. the 6th century B. C.

Udayana is also shown as the 25th or 26th king (LAW, 1939; RAYCHAUDHARI, 1950) in the line of the successors of the Pandavas and if he is to be dated at the time of the Buddha, the 19 Kings intervening between him and Nicaksu would account for about 350 years at the rate of about 18 years per reign. Even this calculation points approximately to the correctness of the dating arrived at by LAL.

There are a few other facts to be taken into consideration. Pradyota, the last great Haihaya king of Avanti or Ujjain, is also known from Buddhist literature to have been a contemporary of the Buddha (RAYCHAUDHARI, 1950, 95) as well as of Udayana of Kausambi, Bimbisara of Magadha, and Prasenajit of Kosala. Pradyota had called for Jivaka, the court physician of Magadha, during a serious illness of him (LAW, 1939, 206). That Jivaka was a historical figure is indicated by the discovery of Jivakamravanavihara (*I. A. R.*, 1953–54, 9; 1954–55, 16–17) at Rajgir in the lower levels of the N. B. P. Ware. Jivaka did attend upon Pradyota, known to Budddhist literature as Chanda-Pradyota, a man of mercurial temper, also called ' Naya-Varjita ' (PARGITER, 1962 b, 267)in the Puranas. But in order to save himself from the wrath of the unpredictable Pradyota had secured his escape by obtaining permission in advance for ingress and egress in respect of his capital city at all times of night and day, and had chosen an elephant for his vehicle to serve him in his search for roots and herbs for the medicine to be administered to Pradyota. This permission could have meaning if only the city had been fortified. The fortified city of Ujjain, had, therefore, come into existence prior to Pradyota.

It is also known that Pradyota had widespread or extensive contacts with North India. He had captured Udayana (RAYCHAUDHARI, 1950, 202), the king of Kausambi on the borders of the two kingdoms by a clever stratagem. He had also tried conclusions on the field with king Pukkusati (RAYCHAUDHARI, 1950, 147, 204, 227–228) of Taxila and Bimbisār a of Magadha. The fact that the Taxila region was swept into sway by the Achaemenid Persian emperor, Darius, about 531 B. C. (TOLMAN; RAPSON, 1960, 81; HERZFELD, 1928, 1; RAYCHAUDHARI, 1950, 240) would antedate Pukkusati, and, therefore, also Pradyota.

The fact that Ajatasatru reinforced the fortifications (*MAJJHIMA NIKAYA*; LAW, 1939, 24) at Rajgir when threatened with an attach by Pradyota on the former's patricide also brings him well into the period.

The prosperity of period II of Ujjain marked by the use of the N. B. P. Ware must also have come in the wake of Pradyota's widespread contacts with the northern plains.

Thus the N. B. P. Ware and associated cultural ensemble could be dated with justification to the sixth century B. C. This would automatically date the Painted Grey Ware still earlier at all the sites where it occurs.

(ii) The Painted Grey Ware and the Aryans—Very interestingly indeed, the Painted Grey Ware has been tentatively and provisionally attributed by Lal to Aryan workmanship. (Lal, 1954–55, 150–1). The grounds adduced in favour of this equation are (i) its distribution in the Ganga plains on sites bearing, till this day, names suggestive of those occurring in the *Mahabharata*, (ii) its extensive occurrence in the valleys of the ancient Sarasvati and Dṛiṣadvati, now Ghaggar, in Bikaner, and (iii) its occurrence stratigraphically above the remains of the Harappans as depicted at Rupar, in District Ambala, Punjab, and Alamgirpur, in District Meerut, Uttar Pradesh, and by inference, in the Bikaner region.

This question will be examined again at a ~~alter~~ stage. later

The date of the last phase of the Painted Grey Ware at Hastinapura (Lal, 1963, 221) has been shown to be cicra 500–300 B. C. by Carbon–14 studies; but the speecimens, which were contaminated by rootlets, could not have yielded correct results. The carbon dates obtained for this ware from such an easterly site as Atranjikhera in District Etah, Uttar Pradesh, has put it at circa 1025 ± 110[4] B. C. Lal had dated the Painted Grey Ware to circa 1100-800 B. C. The foregoing discussion tends to lend support to this empirical calculation earlier devised by Lal.

On this basis the fact that the Painted Grey Ware culture at Kausambi as well as at Ujjain is later in point of emergence indicated alike by its paucity and the simplicity of the painted designs, confining themselves to simple bands around the rims, would justify a date-scheme of its arrival at these later sites around circa 800 B. C. It has, therefore, been suggested by the author that Period I at Ujjain which has yielded well-defined objects of iron would be dated to circa 750–500 B. C.

The upper levels of Period II at Hastinapura, wherefrom objects of iron as well as slags have been reported, should have a comparable date. The same remark holds good for Kausambi, although the postion of Alamgirpur is not clear. Nevertheless, it would also be at least similarly dated. Thus the antiquity of iron can be taken easily to circa 800 B. C. at Hastinapura, Alamgirpur and Kausambi, if not earlier, and to circa 750 B. C. at Ujjain.

In this connection a passing reference may be made to the views respectively of Sir Mortimer Wheeler and D. H. Gordon on the date of the Painted Grey Ware.

Wheeler attrib utes circa 800–500 B. C. (Wheeler, 1959, 26-31) to the Pain ted Grey Ware, and Gordon would not take the Painted Grey Ware earlier than 650 B. C. (Gordon, 1954–55, 175; 1950, 152).

B. Chronology of the Post-Chalcolithic-cum-pre-N. B. P. Ironworks

The pre-N. B. P. Ware ironworks in the post-Chalcolithic phase are evidenced on a small scale in west-central India, mainly at Nagda, with a little support from Prakash, Eran and Bahal.

The cultural equipment of Period II at Nagda is closely related to the cultural assemblage of Period I of Ujjain, and would, therefore, have a corresponding date-scheme, with a possible earlier beginning. This is, to an extent, dependant of the chronology of the preceding cultural peiod (Period I of Nagda), or the Chalcolithic cultures proper.

The evidence of the Chalcolithic cultures in view is large, and is distributed over an extensive area of (i) the Northern Deccan, (ii) Western India, (iii) Central India and (iv) Rajasthan. A distinction, however, is made between the Neolithic Chalcolithic culture, which is confined to the south and the Chalcolithic, which characterizes the western and northern cultures.

Stratigraphically, the limited evidence of Rangpur, Prabhas Patan and Rojdi (RAO, 1963, 20, 24–25, 182, 186) has shown it to be post-Harappan in emergence. This is further indicated by the fact that specially the Harappan cultures and the Chalcolithic cultures of Gujarat, Madhya Pradesh and Saurashtra overlap, and yet there is not much evidence of a cultural link between the two. Considering the fact that carbon dates obtained for some sites take the inception of this cultural complex to circa 2000 B. C., it should be held that these cultures, emerged earlier than the terminal phase of the Harappan cultures and because of the geographical overlap, it would be natural to expect some contact between the two. The present evidence holds them up to be mutually exclusive This is paradoxical, more so in view of some allegedly obvious contacts or parallelism with or influences from distant Iran.

SANKALIA has variously suggested that the Chalcolithic folk might have been indigenous, or an ethnic group of Iran or Aryan tribes who had settled in this region (SANKALIA *et al* 1960, 506–40; SANKALIA, 1962, 272). The limited anthropological evidence from Nevasa (*ibid*, 1960) and Brahmagiri (SARKAR, 1960, 22–24) indicate an indigenous element. The chronological estimate on the basis of C–14 studies seems to go aganist the Aryan theory. The absence of the horse among the painted designs, terracottas or bones is another important contra-indication. The theory about an ethnic movement from Iran is neither proved nor pressed. The contacts of the Chalcolithic cultures with the Painted Grey Ware of the Ganga plains are not yet known. In view, however, of the crucial stratigraphic evidence of a posterior date, serious consideration should be paid to the aspects of the accuracy of the Carbon date. In view of the suggested Iranian contacts a north-to-south trend of movement and expansion for the culture should be stipulated. The stratigraphic evidence in the very northern region is post-Harappan. The date for the more southern cultures on this assumption would be still later. Therefore, either the date of the Chalcolithic culture should be corrected to circa post 1500 B. C., the presently accepted terminal date of the Harappan culture, or this date of the terminal phase of the Harappan cultures revised to suit the Carbon-14 dates. FAIRSERVIS (1956) has indicated the desirbility of refixing the terminal phase of the Harappan culture at circa 1200 B. C., on the basis of C–14 data. This would introduce a further confusion into the situation.

Taking the stratigraphic evidence and general uncertainties regarding the accuracy of Carbon dates into consideration, I should be inclined to date the Chalcolithic cultures to circa 1500 B. C. at the earliest, if not later.

As to the terminal phase the evidence from Nagda, on the analogy of the post-Chalcolithic phase being coeval with period I of Ujjain, datable to circa 750-500 B. C., after accounting for a period of desertion intervening the two phases, points to circa 800 B. C. as the terminal phase. The contacts of the Chalcolithic culture with the succeeding megalithic culture would also point to such a date.

Thus the iron objects from Nagda, Prakash, Bahal, or Eran would have a date around 750 B. C. and would be similarly traced.

C. Megaliths and the Cairn-Burials.

There is almost a consensus of opinion about the megaliths of South India dating back at the earliest to circa 300 B. C. The arguments in support of this theory are well known and are not repeated here. The author has sought to establish in a not-yet-published paper that the megaliths would go back to circa 700 B. C.

The evidence at Brahmagiri, District Chitaldrug, in Mysore, Nagarajunakonda, District Guntur, and Maski, District Raichur, both in Andhra Pradesh, shows the megalithic culture to overlap with the preceding Neolithic-Chalcolithic culture. It has been indicated that the Chalcolithic culture, which impinges itself on the so-called Neolithic culture, can be dated approximately to circa 1500-800 B. C. Thus the Neolithic should at least have a parallel chronological range, if not receding even farther. As it catches up with the megalithic culture in the later levels, the beginnings of megalithism should, therefore, be dated correspondingly.

The similarity of shapes of bowls in the black-and-red ware, including grafitti marks, as seen at Bahal (*I. A. R.*, 1956-57, 17-18) and the adoption of both burial in the full as evidenced at Maski, Sulur, Nagarjunakonda and pit burials elsewhere, and the use of a lime-bed as in the Chalcolithic levels in Nevasa as well as in the megalithic levels at Brahmagiri are common features.

The similarity with the cairn-burials of Pakistan in the shape of the structure, fractional burials, presence of iron objects, horses' heads, and a prototype of the porthole entrance links up the megaliths with the cairn-burials. The cairn-burials again are linked with the Londo ware further north in the form of the painted volutes on the pottery, and the Londo ware in turn with Sialk VI B as well as Luristan pottery. All these help date the cairn-burials to circa 800 B. C., if not earlier, and their impact on the megaliths of south India is clear to see. The presence of a horseman seal at Sialk VI B in Iran establishes another chain in the link. Painted designs of horses on the pottery at Sialk VI B offer further clues of contact between the folks.

Further, the fact of the distribution of the megalithic monuments in south India over the Dravidian linguistic zone suggests a link between the two. It is patent that the Dravidian speakers, who became the exponents of a rich and

variegated cultural life, could not be identified with the neolithic crop-farmers who were the predecessors of the magalith builders. The fact of the occurrence of considerable elements of the Dravidian language on the *Rigvedic* language of the oldest strata (BURROW, 387) would point to a period of coexistence in the land of the five rivers, and a subesequnt movement southwards.

The inscriptions of Asoka on southern soil as at Brahmagiri or elsewere in the Prakrit language would presuppose an earlier movement of the northerners into this region. The highly advanced stage of the Dravidian language, i. e. Tamil, as early the lst century B. C., the Tamil inscriptions in Brahmi script, the existence of four well-established kingdoms of Pandya, Kerala, Chola and Satyaputra in the south at the time of Asoka signify peaceful evolution from much earlier times and surely after the Neolithic cattle farming had ended.

These coupled with the evidence cited earlier would lend credence to the chronological scheme suggested by the author for the megaliths in south India, beginning about 800-700 B. C. As to the components of the culture, iron may have been imbibed from the cairn-burials of Pakistan or from the users of the Painted Grey Ware or from both. It is more likely, in view of their gradual southward movement, for them to have known about iron from the users of the Painted Grey Ware. The megalithic mode of burial may have been imbibed to an extent from the cairn-burial folk as well as from the later Vedic people among whom the practice of collection of calcined bones, their incarceration in an urn, under a mound surrounded by a circle was known (MACDONELL and KEITH, 1912, I, 8-9; KANE, 1953, 246) The black-and-red ware pottery may have been imbibed from the Ganga plains or from the Chalcolithic folks. Recent explorations in the Mirzapur and Varanasi Districts have brought to light megalithic remains without iron. These, if indigenous, may as well have influenced the megalith builders of the south.

It would not be out of place to mention that the skeletal remains from Brahmagiri (SARKAR, 1960) and Yelleswaram (GUPTA & DUTTA, 1962) have shown a predominant round-head or brachycephalic character, though an admixture of native Australoid and hybrids, being the result of intermarriage, also reported. The brachycephalic element as well as the port-hole characteristic indicate an influence from the direction of Iran i. e. Sialk VI B, and would lend support to the date-scheme.

The report by FAIRSEAVIS of port-hole dolmens in the region of Karachi recently provides a possible connecting link, and is in a line with the passage at Dambakoh (STEIN, 1937, 74) among the cairn-burials.

HEINE-GELDERN has arrived at a similar conclusion on the source of megaliths in India though he would date the megalithic culture a little later i. e. circa 600 B. C.

The plethora and large variety of the iron equipment of the megaliths may suggest an independent origin and development of iron in the south. The plethora and varietv is easily explained by the large numbers of deposits of iron ores almost throughout the Peninsula. The well-preserved condition of the iron

objects in the megaliths is best explained in the words of WHEELER (1959, 164): "Its (iron's) impressive quantity and quality owe much to the accident of preservation in protective (i. e. megalithic) tombs. The scrappy remains of iron-work from the 'Megalithic' levels of Brahmagiri would never, unsupported, have suggested the extent of the industry. *Per contra*, had megalithic tombs been built besides the Gangetic cites of the Iron Age, there can be no doubt that their display would have been correspondingly striking".

The fact of the occurrence of iron objects inside megalithic monuments in the Leh (FRANCKE, 1909-10, 104) valley of Ladakh, and Visalpur (GORDON, 1958, 161), Rajasthan, would be contra-indications against a purely southern evolution. In the evolution of the iron equipments within the megaliths the trend noticed is easily from the north to the south, the maximum variety being displayed in the urn-burials at Adichanallur, in District Tirunelveli. It must also be observed that iron objects in the megalithic tombs at Junapani in District Nagpur, in the northernmost region of the Peninsular zone display considerable variety and evolution, though by no means comparable to the sophistication of Adichanallur in the extreme south. It would, however, be worthwhile to mention that the hatchet with diagonal straps for fastening is common to Junapani and Adichanallur. It would not be wrong, therefore, to state that the megalithic culture entered into the south with a developed iron technology, which met with a wider scope in the region and underwent further development, because of extremely rich deposits of iron ores all over the region.

The tradition of the iron workers of Avanti (Ujjain), in distant north, being called upon to execute the ironworks in the palace of a Tamil King, recorded in the Tamil works, Manimekalai and Perungadai, of the early centuries of the the Christian era along with the craftsmen from Vatsa (Kausambi), artisans from Magadha, Yavana carpenters all working in unison with Tamil workers is significant in this context. It would point to a deep-seated and rooted focus of ironwork technology in the north, which was obviously, much superior to the indigenous workers of the south to deserve a royal commission. This should be considered in the context of the Manimekalai, dated to the sixth century A. D. (PILLAI, 1959) recording all the diverse ramifications of megalithic monuments, and of an inscriptional record of the megalithic practice being prevalent as late as the thirteenth century A. D.

D. The Chalcolithic Culture.

The chronology of the Chalcolithic culture in general has been dealt with in connecion with the date of the megaliths. To repeat, I would suggest the fixation of the chronology broadly at circa 1500-800 B. C.

4. Users of the Painted Grey Ware Introduced Iron in North India.

(i) General—The evidence of the earliest occurrence of iron in north India, associated with the users of the Painted Grey Ware, leads to the question of who these people were, and wherefrom they imbibed this new metal and its technology. WHEELER (1959, 28) has modified LAL's provisional attribution of this ware to the Aryans by equating the users of the Painted Grey

Ware with the second wave of the invasion of the Aryans into Ganga plains from the Punjab.

The claims of diverse cultural assemblages to being identified with the Aryans are examined below.

(ii) Harappans and the Aryans.—As regards the claims sometimes made on behalf of the Harappan civilization that it was the handiwork of the Aryans, the factors of its geographical distribution, architectural achievements, and urban life, and religion involving Pasupati, phallic emblems, mother goddesses, and an order of priests, its system of weights and measures, seals, roads, drains, and other equipments and even disposal of the dead are far removed from the simple pastoral life of the Vedic people who believed in Indra, Varuna, Agni, Surya and other deified aspects of nature and in sacrifices etc. The fact that the Harappans knew a script, though still unknown to us, contrasts against the traditional transmission by a tortuous and exacting process of the Vedic lore by word of mouth from generation to generation without being committed to writing. The chronological incompatibility of the *Ṛigveda*, which linguistically cannot be dated very much prior to circa 1000 B. C. (GHOSH, 1951) with the Harappan civilization, known to go back to 2500 B. C. is another jarring feature in respect of the latter's claims to Aryan authorship. The presence of Mediterranean and Australoid elements among the population of the Harappans is another contra-indication (WHEELER, 1960, 98).

(iii) Chalcolithic cultures of West-Central India and the Aryans. :— SANKALIA (1958, 249-252; 1952, 272-3) has voiced a hesitant claim for certain late features in the Chalcolithic cultures of western India and northern Deccan for attribution to Aryan immigration from the direction of Iran about 1000 B. C.

The factor of geographical distribution of these cultures away from the central focus of the Aryan settlement is obvious.

The Iranian influence, adduced by SANKALIA, confines itself to some pot shapes in the ceramic or metallic materials, designs of paintings or shapes of weapons. Such borrowings, neither on a large scale nor as a regular feature, would imply at most contacts of some kind. If the contact of the Chalcolithic cultures of west-central India with the Iron Age phase of Iran, i. e. Sialk VI B, was really effective, in the sense of a folk movement instead of commercial exchanges, it would be but natural to expect some iron more than pottery or other materials. The fact that iron was not imported in spite of its superior potentialities would only indicate that the contact was not substantial or may be the two cultures were fundamentally different.

But the most significant aspect of the question is the absence of the horse in any conceivable form from the Chalcolithic cultures. Neither bones, nor terracottas, nor paintings on the pottery represent the horse, and yet the horse motif was not only common in the painted designs in Sialk VI B, but horsemen seals were commonly used. In fact horse breeding was one of the principal occupations of the Iranians at this time. It is difficult to conceive of the Aryans without the horse and chariot. This contrasts also with the presence of the horse

at Hastinapura. A claim has been made for the existence of a terracotta horse at Lothal. In view of the singular absence of the horse from the entire range of the Harappan civilization, in spite of ample scope for its portrayal in seals, terracottas, paintings on pottery, not to speak of horse bones in the Harappa culture, the striking and doubtful specimen from Lothal can be discounted, particularly because one is not sure of the hoof, mane or bushy tail.

The limited skeletal data from Novasa (EHRHARDT, 1960) have shown the prevalence of the native Australoid element among the Chalcolithic people, pointing in the direction of an indigenous folk.

(iv) Post-Harappan Cultures in the North-West of the Indo-Pakistan subcontinent and the Aryans :—

The end of the Harappa Civilization was followed by a number of scrappy cultural complexes, limited alike in chronological range, as judged from the depth of strata, and in regional distribution in the north of the subcontinent. This limited aspect, more than any other, would deprecate any attempt at the equation of these complexes with the Aryans. As Wheeler sought to explain it, the decline and decay of the great Indus civilization was followed by "cultural fragmentation", which displayed itself in the emergence of distinct and mutually exclusive cultural groups. These were described by WHEELER as "beggarly successors" of the great Indus civilization but deriving very little from a sub-Indus heritage. Stuart PIGGOTT called them the 'conquerers" of the Indus civilization.

These comprise the cultural traits represented by (i) Cemetery H at Harappa and a few other sites, (WHEELER, 1947, 58–130; GUHA, 1944; LAL, 1953), (ii) the cemetery at Shahi-tump (STEIN, 1931, 88–103), (iii) Jhukar and (iv) Jhangar as represented by Periods II and III, respectively, at Chanhu-daro, (v) the Cairn-Burials (MAJUMDAR, 1934, 3–18; MACKAY, 1943, 103–132; PIGGOTT, 1950, 221–226; in Persian and Baluch Makran and Baluchistan, STEIN, 1929; 1931); (vi) the Londo Ware (DE CARDI, 1951, 63), (vii) Rana Ghundai IV and V (PIGGOTT, 1950) beside (viii) the Trihni Ware (MAJUMDAR, 1934, XXII and XXIV, fig. 14 and 18; GORDON, 1954–55, 170–1) interposing itself between Jhukar and Jhangar.

(v) "Copper Hoards" and the Aryans :—

The copper implements which have been found at a number of places in the Ganga plains, in Bihar and Orissa and isolatedly eleswhere, usually in hoards, have not been, except very limitedly, found in stratigraphic contexts and have, therefore, posed a problem of their cultural affinity.

It was HEINE-GELDERN (1936, 87–113; 1937, 7–16; 1956, 136–140) who first wrote that they were the handiwork of the Aryans. Stuart PIGGOTT (1944; 1950, 173–182), however, thought that they were the remains of the Harappan refugees after the break up of the Harappan civilization, though he had earlier attributed them to the Aryans B. B. LAL (1951, 20–39; 1953, 91–93) reviewed the position and came to the conclusion that the makers and users of the hoards were neither Harappans nor Aryans, but indigenous people on the basis of similarities of the tool forms to earlier stone prototypes, or to painted desings in rock shelters, and their circumstantial association with a distinctive yet degenerate pottery called the Ochre-Coloured Pottery. The existence of a fewtool types in the

miscellany of (i) the trunnion axe of Shalozan, (ii) the shaft hole axe of Mohenjo-daro, (iii) the Fort-Munro sword of Rajanpur and (iv) a mace head at Jhukar, (v) besides a pin topped by the figure of a dog at Mohenjo-daro with West Asian affinities could be attributed to some Aryans tribes who shared in the invasion of India. But the bulk of the tool types comprising the eight varieties of (i) flat celts, (ii) bar celts, (iii) shouldered celts, (iv) antennae swords, (v) harpoons, (vi) rings, (vii) anthropomorphic shapes, and (viii) hooked spear-heads are indigenous.

Recent discoveries of Ochre-Coloured Pottery at Bahadarabad, in District Dehradun, Manpur and Bhatpura, in District Bulandshahar, (*I. A. R.*, 1957–58, 30) and Ambkheri have shown the prevalence of Harappan shapes in gradually degenerating forms in the eastern direction. It is also to be considered that there was a mass of copper objects, though not in stratigraphic context at Bahadarabad as well as at Manpur.

The occurrence of distinctive objects of copper such as an antennae sword at Chandoli (*I. A. R.*, 1960–61, 27, XXIV, fig. 2) a dagger with a mid-rib at Navdatoli in a stratified context (*I. A. R.*, 1957–58, 30, XXXVII A), and a broken copper form of the anthropomorphic objects in the upper levels of Lothal (*I. A. R.*, 1957–58, 13, XXI A) connect these stratigraphically with the later phases of the Chalcolithic cultures of western India.

In this context it should also be considered that if the Aryans, who settled first in the Sarasvati-Drishadvati Valley and then in the Ganga plain, were identical with the makers of the copper implements in question, the absence of copper objects in the Sarasvati-Drishadvati Valley is not easy to explain. Secondly such versatile and conventional shapes as the 'Copper Hoard' miscellany comprised found none of its influence on the later objects of iron in India. This obvious discrepancy has to be attributed to a different source of their authorship. An iron sword recalling the antennae swords of the 'Copper Hoards' has, However, been reported from the late medieval levels of Eran (Bajpai, 1964, 30–31, XXII, fig. 1).

If the makees of the Ochre-Coloured Pottery, which now purports to be a degenerate phase of the Harappan pottery, attributed to refugees, and the makers of the copper implements are identical, it is easy to explain their intermediate chronological and stratigraphical position between the Harappans on the one hand and the Painted Grey Ware on the other on the basis of the evidence at Rupar and Hastinapura. It should also be noted that some copper or bronze implements found in the upper levels of Mohenjo-daro and Chanhu-daro (Jhukar phase) are dated to circa 1200 B. C. Fairservis' suggestion for the refixation of the date of the terminal phase of the Harappa Culture at about 1200 B. C. may, in this context, be recalled. The two cultures flourished successively on the same sites as seen at Rupar and Alamgirpur, and no doubt, in Bikaner as well. But the lack of the evidence of a contact between the Harappans and the users of the Painted Grey Ware would, therefore, account for an intermediate phase of invasion, conquests and confusion created by the arrival of several groups of people about this time. It was, therefore, likely that the Painted Grey Ware users came

a little later on the scene to join the fray. It is also to be noted that no other cultural element or entity is encountered in the region, which became ultimately the centre of Aryan activity.

Though J. E. van LOHUIZEN de LEEUW (1960) has attributed all the copper objects and "Hoards" to the Chalcolithic cultures she has not been able to show any substantial *raison d' etre* in support of her theory.

It has been ably pointed out by D. H. GORDON (1958, 146–48) that the copper antennae swords at Kallur, District Raichur, Andhra Pradesh, though not strictly similar to the Fategarh swords of the Ganga plains, are not locally manufactured but imported from the eastern zone. The extremely rare occurrence of copper celts at Navdatoli, an antennae dagger at Chandoli, a dagger with midrib at Nevasa similarly can at best show contemporaneity and import but not an integral element of the indigenous Chalcolithic culture. Likewise the stray occurrence of the broken copper man at Lothal in the upper levels can be easily explained if the "Copper Hoards" are attributed either to the Harappan refugees or to indigenous authorship.

The position, therefore, in respect of the "Copper Hoards" is that they were not the products of Aryans in the Ganga plains (SHARMA, 1961).

VI. The Users of the Painted Grey Ware and the Aryans : their original home and acquaintance with iron :—

The process of elimination leaves the field clear for the users of the Painted Grey Ware to be identified with the Aryans. This attempted equation would raise the question as to the original home of the Aryans, the course of their movement, and if they acquired the knowledge of iron in India, or were acquainted with it even before their immigration into the country.

As to the original home of the Aryans, the most diverse opinions and theories have been expressed. According to the different views any place between Greenland and Siberia, including India itself, could have been the original home. There is, however, a large measure of agreement that the original home lay somewhere in Central Asia to the south of Russia, which served as the spring-board of the Aryan emigration to different directions.

The Hittites, a Indo-European stock of the centum group are known to have settled in Asia Minor about 1950 B. C. (*Encyclopaedia Brittanica*, 1959, II, 589B). A little earlier about 2000 B. C., the Mitannis,an Aryan aristocracy, settled, in Upper Mesopotamia. For some time the Mittannians (WINCKLER, 1907, 51) were at war with Hittites until peace was settled between the two in the 1865 B. C. as recorded in the Boghaz Keui inscription. The Mitannis, who had adopted the Hurrian language of the land, owed their superiority in the new land of their adoption to their use of the horse and chariot and knowledge of iron. An exquisite axe with an iron blade and bronze grip, found at Ras Shamara, dated to circa 1450 B. C. (SCHAFFER, 1939) stands as an example of their superior workmanship. The knowledge of iron technology was obtained by the Hittites from the Mitannis and made into a royal monopoly of which there is ample evidence.

The Boghaz Keui treaty called to witness a hundred gods and goddesses of the two countries and among them were the Mitanni deities, Mitra, Varuna, Indra

and Nasatyas (WINCKLER, 1907) who are familiar to us as Rigvedic deities mentioned in the text in the same sequence. (*Ṛigveda*, VIII, 26, 9). Besides, it must be to the noted that the plural form an in "*Na-Sa-at-ti-an-na*" used in the context conforms Rigvedic dual *Nasatyau* (*dvandva-sawasa*). The connection between the Mitannis and the Rigvedic Aryans is thus clear to see, and also that the *Rigvedic* way of living had been evolved even before the Mitannis left their original home. The proper names of persons and places associated with the Mitannis also indicate linguistically an Indo-Aryan stage i. e. pre-birfurcation phase of Iranian and Indo-Aryan languages.

There was yet another group of Aryans, the Kassites, ruling in the eastern parts of Mesopotamia, between circa 1900 and 1171 B. C. They had Suriash (GHIRSHMAN, 1961, 64-65) Surya, Sun god, and Buriash (=Usha) or Boreas, the Greek god, as their deities.

It would be tortuous to go through all the arguments against an oft-cited theory of the Indo-Aryans emigrating from India and establishing a colony in the Mitanni area. It would suffice to state that these traces of Aryan people were obviously links in the chain of widespread movements that had taken place leading to the immigration into India.

The fact that the date of certain objects found in the upper levels of the Harappan stratigraphy has been assessed at circa 1 200-1100 B. C., being of West Asian affinity, in combination with FAIRSERVIS' suggestion of a comparable date for the end of Harappa, helps to fix tentatively the date of the Aryan immigration.

It is well known that Iran had iron about this time in considerable measure i. e. in Sialk VI B, with a beginning in the earlier phase of Sialk V A, though bronze still held its sway. There were composite objects of bronze and iron at several sites in upper Iran at this time, marking a transitional phase. It cannot, therefore, be denied that the Iron Age technology had started in Iran about that time.

The Indo-Aryans must necessarily have lived together with the Iranians for a considerable time before passing on to India. This is indicated by the similarity of the languages of the Iranians and the Indo-Aryans. It is also known that phonetically the two languages remained akin upto 775 B. C. when the sound of 'S' had not changed to 'H' in Iranian. This would indicate that the separation of groups of people was not very much earlier than this date. There are obvious geographical names in the *Ṛigveda* which show contact with the Iranians, namely, Haraiva=Sarayu, Harahuvatish=Sarasvati, Ranha=Rasa, besides such common words as Parsu, Parasavya, Prithu-parsavya and Balhika occurring in the *Atharvaveda* have parallels in the form of Parthava, Parsa and Bakhtrish respectively in the old Persian inscriptions. The name of the Indian province in the *Avesta* is Hapta Hindu, while the Ṛigvedic form is Sapta Sindhava. More examples of parallelisms in the languages can be cited. The new religion of Zoroastrianism that sprang up in Iran was the result of a revolt against the traditional ideas, and the date of Zoroaster has been fixed at 630 B. C. Even in religion there are obvious links between the two peoples.

The contact between Iranian and Indo-Aryans should obviously have been both before and after the Iranians' arrival in Iran. A part of the folks remained behind in Iran and the rest pressed on forward. The Indo-Aryans were, therefore, quite well acquainted with the use of iron before their entry into India. If, however, they brought any iron equipments with them archaeology is yet to reveal.

In this context it should be considered that B. K. GHOSH (1951) held the view that the date of the *Ṛigveda* could not be earlier than circa 1000 B. C., linguistically, in comparison with the *Ashtadhyayi* of PANINI.

In this connection it may be pointed out that a section of the Sialk VI folk themselves may have formed the Aryan nucleus and moved to India. The skeletal remains from Sialk VI, studied by M. VALLOIS (1939) were found to be predominantly of the Armenoid type, attributed to Aryan speakers. The arrival of Sialk VI people and the spread of iron go well together and has been recognized as the result of the folk movements caused by the expulsion of the Hittites from Asia Minor, by the invasion of the Thraco-Phrygians about 1190 B. C.

Despite their acquaintance with iron it would not have been possible for the Aryans to start the manufacture of objects of iron all at once. They had first to settle in a new country, look for ores and then in due course of time start the making of iron objects. The evidence at hand points to just such a phenomenon. The two large deposits of iron ores in northern India are concentrated in Mandi, Himachal Pradesh and Narnaul, Punjab respectively. No large scale experimentation or development of the manufacture of iron objects could possibly be undertaken until the ores could be extracted from either of these two major sources. This itself would account for a time-lag between the arrival of the Aryans on the scene and the local manufacture of iron objects.

A question that will naturally arise is if the Aryans in India tentatively identified with the users of the Painted Grey Ware had brought the pottery along with them from outside. Though an immigrating folk can be expected to carry their essential equipments of hunt and warfare and some stores of food and clothing it is difficult to imagine their transporting quantities of pottery, except, of course, convenient water vessels. It would also not be necessary for them to carry the pottery as they can always adopt the local pottery. The *Ṛigveda* does not mention any pottery nor pottery directly, but the *Atharvaveda* (4, 17, 4) mentions pottery as *Nilalohita* (ZIMMER, 1879, 253), meaning bluish red and the blue-red or reddish blue or blue and red as the case may be.

This seems to describe, to an extent the bluish tinged Grey Ware, as well as the brownish red ware, which goes with it and covers the same shapes, as found at Hastinapura and Ahichchhatra. This was indeed a *de luxe* ware, and for this they may not have been required to look farther than Shahi-tump, where a distinctively fine Painted Grey Ware was in use. Though LAL has adduced parallels from Afghanistan, Shah Tepe and Thessaly, the interconnection with such distant sources is less easy to see. It has been observed in Lakhiyopir to the north of Karachi in Pakistan. Similar pottery has been reported from Hasanlu (SANKALIA, 1962, 270; DYSON, 1961) in Persian Azerbaijan, dated to 1000-800 B. C., and

attributed to Indo-Aryans. In this connexion a reference may be made to the corrugated stem of, apparently, a dish or cup-on-stand in plain red ware in association with the Painted Grey Ware at Ahichchhatra. These are indicative of local adaptations of deep-rooted ideas, say, of burning incense or keeping offerings, in common.

It is true that the cutulral life obtaining among the users of the Painted Grey Ware is extremely simple in sharp contrast to the mighty civilization of the Harappans. The life of the Vedic people was indeed simple pastoral, country life with belief in the forces of nature. Limited excavations have so far enabled us to know about their pottery, mud houses, food consisting of beef, pork and venison, use of copper and iron and the horse (SANKALIA, 1962, 185). The fact remains that the variegated life of the Harappans has not been followed by anything like it in the cultural phases of subsequent periods exposed so far.

5. Typological Comparison of the Iron Objects from Iran, especially Sialk, and from the Early Iron Age in India.

A comparison of the tool types from Iran and India in the early days of iron in both the countries would indicate some obvious parallels. Though it is not yet possible firmly to establish an evolutional link between the two regions, it is clear that their links are close enough to lead to such a possibility. At Agha Evlar and Chagoulla Derre the iron objects, mostly weapons of war show a different tradition from that obtaining in Sialk V or Silak VI, though the two groups are not very far removed from each other in point of time. The tools at Agha Evlar consist of daggers, axes, chisels, spearheads, and horse-bits. The daggers follow the earlier tradition of bronze tool with a long narrow tongue with median groove, springing from a hilted end. The axe has a splayed cutting edge, and a barrel-shaped transverse socket for the grip. The chisel has a broad, slightly splayed working end and tanged end for the hafting into a handle. The spear-head is almond or leaf-shaped with a socketed hollow stem.

At Chagoulla Derre the spear heads are longish and conical, usually with a median rib and hollow socketed stems for fixing to a shaft. The daggers have diverse handles made of bronze which are clasped at the broader end. That iron objects were preferred for their greater effectiveness is clearly indicated by the blades being made of iron in preference to those of bronze, while the less functional part was made of bronze. The continued adherence to the hybrid form was possibly more as a matter of habit and sentimental inability to part with an ancient relic than pure considerations of utility.

At Sialk the hybrid combination has almost disappeared, obviously for reasons of a wastefully lengthier process of manufacture involved in it. A complete piece of tool could be produced with greater convenience and quicker than a composite tool, especially as bronze started losing ground as functi o nal metal and began to have more of decorative utility at the stage. At any rate, its inferiority to iron in striking power was recognized. While it was easy to emulate the spear-heads, it had become obsolete to produce hybrid daggers and hence wisely discarded. The clasped joint was also a possible source of weakness, regardless of the offchance of the handles loosening themselves in course of time at the point of junction.

The simpler forms of Sialk V A, or VI B consisting as they did, of arrow-heads, spear heads, daggers, sickles and the horse-bits show indeed greater affinity with the tool types in the Painted Grey Ware levels and the succeeding levels of the Northern Black Polished Ware and even of the megaliths themselves, to a certain extent. The ensemble itself, to begin with, is apparently larger in scope than that obtaining in the contemporary levels of Chagoulle Derre ar Agha Evlar, and are indicative of increasingly larger applications of the new metal.

A comparison of Sialk objects with those from the cairn-burials also suggests a family affinity. The simple forms of the spear heads or arrow head from Moghul Ghundai points to an advancement beyond the rudimentary stage. Such forms, as stated earlier, had parallels in Afghanistan and points to its possible source or direction of inspiration. Segmented or barbed arrow heads occur in the megaliths as well, and lend support to the interconnection between them and the cairn-burials.

The occurrence of a broken sword blade of iron with a bronze fastening at the hilt at Zangian (STEIN, 1931, 88) is another link with Iran and helps to give the story of the inferred interconnection between the two away.

It is abundantly clear, however, that the tool forms of the "Copper Hoards" assemblage did not influence the Iron Age equipment. There is hardly any typological connection between the two, conceding that the "Copper Hoards" had preceded in emergence the iron objects. The tools of possible western affinity did not impart any of its verve or form to the Iron Age either.

The few copper tools found in early occupational levels in Indian stratigraphy, including a thin leafshaped arrow head in Hastinapura, do not represent or indicate a basically different typological bias.

The source of the forms of tools evolved in iron have, therefore, to be looked for elsewhere. They may have grown locally in response to the environment, or they followed the tool forms with which the folks had already been familiar. After all the Aryan invaders had forced their way through the most virile part of the subcontinent with efficient armour of their own without which the displacement of the once mighty Harappans would have been impossible. The close connection between the Sialk tool forms and those of the early Iron Age in India points almost to an irresistable inference which had indeed the semblance of probability.

6. Iron Objects from the Early Historical Levels.

Apart from the objects of iron found in the levels of the Painted Grey Ware, a good volume of iron objects has been reclaimed from the early historical period, characterized by the N. B. P. Ware. There are traces of slag throughout the country indicating a countrywide manufacture.

The objects at Taxila (MARSHALL, 1951, 63) comprise a short dagger blade, a carpenter's adze and a straight-edged convex-backed knife. Hastinapura (LAL, 1954-55, 97-98) has yielded a barbed and socketed arrow head, a chisel and a bracelet with unconnected ends. At Rupar (*I. A. R.*, 1953-54, 6-7; 1954-55 9; SHARMA, 1953, 125) the iron objects comprise nails, hooks, bars, spikes with socket, handles, knives, daggers, sickles and spear heads. The miscellany of objects of Nasik (SANKALIA, 1955, 109-116) comprise leaf-shaped arrow heads,

caltraps, choppers, concavo-convex knife-blades, tang fragments, axes, drills, chisels of circular cross-section, lamps, or ladles rings and nails. Nagda has yieled a large repertoire of knives, daggers, chisels, sickles with curved blades, arrowheads, of square rectangular and hexagonal cross sections respectively, occasionally with tangs, double-edged daggers, hoes, a *khadga*-shaped knife, nails and bowls, reflecting at once the settled nature of the use of iron and the many sidedness of its use. Bahal (*I. A. R.*, 1956-57, 19) has yielded spear heads, knives, daggers and sickels. The objects at Sonpur (*I. A. R.*, 1956-57, 19) in Bihar, comprise nails and blades.

Examples could easily be multiplied. The miscellany of iron objects in this period show a preponderance of tools and weapons of warfare comprising daggers, knives, swords, arrow heads, spear heads, spikes and caltrops. Those of domestic use comprise blades, hooks, nails, chisels, drills, axes, lamps, ladles, bowls and rings. Iron had also penetrated the field of agriculture in the form of hoes, choppers, hooks and sickles./

7. Evidence on the Technology of Ironworks.

From the point of view of technology iron in India must have developed well enough to merit a mention by Xerxes (Herodotus, VII, 65; Forbes, 1950, 435) of the fight of Indian soldiers with bows tipped with iron on behalf of the Persians in their battles against the Greeks. Ktesias (Warmington, 257-58) mentioned the receipt of the gifts of two swords, respectively from the Achaemenid Persian emperor and his mother. Alexander the Great was glad to seal a treaty with the defeated King of Taxila, Porus, with the gift of just 30 lbs. of steel. (Forbes, 1950). The well-known Damascus steel is said to have been of Indian origin.

All this would indicate the development of an advanced technique of ironwork metallurgy long before the times of Alexander. Though archaeology has yielded specimens of iron objects from early times, they have not been adequately studied for their technological processes.)

The quantity of carbon mixed with iron, and the qualities of resultant iron, the processes of making the alloy or the impregnation, if at all, of other elements are as yet unknown factors. Nothing short of a scientific analysis of the composition of the iron objects and comparison of the results with the composition of different kinds of ores available in the region would advance our knowledge on the subject.

(There is precious little evidence from archaeology as to the processes of smelting or forging objects of iron in ancient India.) In this respect the practice of the primitive iron-smelters, the Agarias, can at best offer a clue. The primitives by and large employ a vertical cylindrical shaft, open at the top for smelting purposes. The shaft is charged with alternative beds of charcoal and iron ores, and fired from below. At the bottom are two openings on the sides of the shaft, one for introducing the nozzle of the bellows and the other for the escape of spongy masses of the metal. The red hot spongy mass is taken out and hammered for the elimination of slags or gague that forms as a result of the heating. The lumps of iron thus produced are employed for the manufacture of various objects

of iron. In the process iron ores get impregnated with some uncontrolled quantity of carbon and become hard and acquire the properties of steel. This process is called carburization. The dipping of a red hot object or lump into water is called quenching which helps to harden it. The tempering of iron consists in localized steeling of iron by repeated heating and slow cooling. These aspects could be ascertained by subjecting the specimens to examination for hardness or sharpness etc., by the National Institute of Metallurgy at Jamshedpur.

In the South the practice was obviously to smelt iron in crucibles and produce what is known as wootz steel. It was, however, not before the achievement of a high temperature of 1350°C. that iron ores could be smelted properly and fully.

Ujjain has yielded the evidence of the use of some kind of a bowl furnace laid into the earth. Alternate charges of charcoal and ores were inferably arranged in a circular pit, and it is subsequently covered up, leaving passages for draft of wind to keep the fire alive. The softened spongy masses of metal were later collected and hammered to obtain the metal. Lime or some kind of calcium carbonate is used along with the iron ores to serve as a flux or catalytic agent in the smelting processes. The prevalence of large quantities of argonite and calcite in the immediately post-N. B. P. levels and deposits of slag and whitish powder in section, presumably the remains of calcite or argonite, point to such a process. In the evolution of metallurgy, the use of a flux is a fairly late event, and discovery of calcite or argonite and slags at such an early date as circa 200 B. C. point to a long period of experimentation and an early beginning. By the side of the iron works was a longitudinal water channel in Ujjain, the waters of which more than supplied the needs of the iron industry for quenching and tempering etc.

Period II of Ujain (i. e. the N. B. P. levels) has also yielded the evidence of a bla cksmith's forge. It consists of a furnace with an opening for introducing the nozzle of the bellows for the fire, a tall-sided dish to contain water for quenching, the neck of a large jar firmly fixed into the floor for supporting a water vessel, small miniature vessels lying on their sides in the neighbourhood for drawing water in small quantities, a couple of finished iron objects lying on the floor alongside, presenting a complete picture of a blacksmith's forge.

As to the collection of ores it was noticed that mammiliated lumps of limonite, which were available in plenty in the veins of the trap rock in the neighbourhood, were employed at Ujjain.

(The ancient indus tries connected with the smelting of iron ores and the manufacture of finished objects would naturally be located near the twin requisites of ores and fuel. A look at the distribution map of the principal ores in India (KRISHNAN, 1954) would permit such concentrations in the south and east respectively. The Peninsular areas of distribution are around (i) Goa in Goa (ii) Ratnagiri and Chanda, in the Maharashtra area, (iii) Bababudan in Mysore, (iv) Salem in Madras, (v) and Kurnool and Adilabad in Andhra Pradesh. The north Indian deposits are in (i) Palamau and Singhbhum in Bihar, (ii) Keonjhar

and Bonai in Orissa, (iii) Mandi in Himachal Pradesh, and (iv) Narnaul in Punjab. Besides these there are diverse minor deposits here and there. For the northern parts of India the ores from Mandi, and more so, from Narnaul should have been handy, and it was not until the discovery of these ores that iron could be manufactured on any appreciable scale. The large distribution of iron ores in the south was, naturally, exploited fully by the megalith builders. This also accounts to an extent for the plethora of iron objects among them as explained earlier.

8. Literary Evidence on the Use of Iron in Ancient India.

The literary evidence on the use of iron in ancient India are well known but it does not help the appreciation of the Iron Age in India except limitedly. The controversy over the significance of Rigvedic *ayas* has not died down and need not, therefore, be revived. In the age of the *Atharvaveda* two kinds of *ayas*, namely *Krishnayas* and *Lohitayas*, are recognized, and one of them must refer to iron. The literary references to Herodotus, Ktesias, and Alexander as being acquainted with Indian iron or steel, in their respective times, are well known and have been mentioned before, (WARMINGTON p. 258) has adduced evidence for the export of steel from India to the Roman empire in the early centuries of the Christian era.

The most interesting, evidence, however, is recorded in Kautilya's *Arthasastra* according to which the quarrying, mining and connected industrial activities were subject to taxation and control by a *loha-adhyakṣa* (MOOKERJEE, 1960, 106) or Inspector of Mines in modern terminology, employed by the State in recognition of the taxable surplus of wealth produced by iron.

9. Some Aspects of Life in the Iron Age.

Piecing together the evidence of a multitude of cultural objects, pottery and equipment of metal a fairly comprehensive picture of a variegated life during the early Iron Age can be reclaimed. The stage, nevertheless, is premature to gather a complete picture of life in all its aspects. Apart from such simple corollaries derived from iron as the increased power to cut down forests, lay roads, procure large quantities of fuel, widen geographical contacts, diversify life's needs and demands, the fact remains that the period witnessed the emergence of extensive monastic life, almost throughout the country especially among the Jainas and the Buddhists. The very fact that the society was able to sustain such a large number of able bodied drones presupposes the collection of surplus funds in the hands of both the royalty and the nobility who patronised them. We have heard of the Ghoshitarama monastery, being the gift of a banker, and of Jivakamravanavihara, attributed to a court physician. Such surplus wealth presupposes establishment of industries and quickening up and expansion of agriculture, utilization of forest wealth, and mining and quarrying, which became organised enough in the times of Kautilya to warrant State controlled supervision and taxation. It would be logical to concede that the ministration which the Buddhist and Jaina monastic orders practised and the freedom they enjoyed in this task would scarcely have been possible without royal or State patronage and fiscal support, The underlying prosperity was the outcome of the new horizons of

material life encampassed by the limitless potentialities of the new metal. This was one of the biggest contributions of iron to life in India in the ancient tim es.

10. Conclusion.

The foregoing discussion has sought to establish that it was the Aryan settlers in India, who also used the distinctive Painted Grey Ware ceramic, that were the first to use iron in ancient India around 800 B. C. or even earlier. Almost simultaneously or slightly later, the use of iron is testified among the people who buried fragmentary remains of their dead in cairns in the borders of Iran and Pakistan. It is possible that they obtained their knowledge of iron from Sialk VI in Iran even as the Aryans of the Ganga plains did. A little later iron comes into its own in west-central India in the post-Chalcolithic phase as also in the megaliths of south India. In both cases the advent of iron is apparently later than its arrival in the Ganga plains, and possibly, on that score, they, especially, the megaliths, owe not a little of its metallic inspiration to the northern plains. The possibility of a cultural influence direct from Iran (Sialk VI) being transmitted through the cairn-burials to the megaliths of south India, with substantial traces in the intermediate regions, cannot be ruled out. While Dravidian speakers appear to have taken a special fancy to the megalithic mode of disposal of the dead, considerable numbers of a brachycephalic people, akin to the Sialk VI folk, were present in their midst to accentuate the megalithic order of life.

The relative superiority of the northerly Aryans in arms, more than in numbers, would possibly account for the ultimate confinement of the Dravidian speakers, who had earlier lived in the Indus plains, into Peninsular India, and would, by inference, confer on the Aryans the glories of being pioneers in a new metallurgical experience in the new land of their adoption.

Endeavours to associate the Achaemenid Persians, after Darius, with the introduction of iron into India have not found support from archaeological evidence.

As to the indigenous origin, the evidence is too thin as yet, and does not lend itself so far to a stratigraphical correlation with any antecedent or precedent cultural milieu.

The early Iron Age in India, can, therefore, be dated between circa 800 B. C. and 200 B. C., and the prime responsibility for introducing it in India and spreading it far and wide within the subcontinent can be tentatively fixed on the Aryan endeavour.

D. P. Agrawal :

I think if the evidence put forward by Dr. Banerjee, is put in a different chronological perspective it will become more consistent. Banerjee's contention that the Iron Age in India starts in circa 800 B. C. does not seem to be correct. I will, therefore, confine myself to the chronological problems raised in his paper.

Banerjee has perceived some major discrepancy between the archeological evidence and the radiocarbon dates. He has said that C-14 dates suggest that the Chalcolithic cultures start about circa 2000 B. C. thereby making them overlap chronologically with the Harappa Culture. Whereas C-14 dates in fact present

a very consistent pictures as the plots (pp. 139 & 140) would lshow. The Harappa Culture comes to an end about circa 1750 B. C. and the Chalcoithic cultures start around this very date. Radiocarbon dates show that the early Neolithic Culture of the South flourished during circa 2300–2100 B. C.; the Harappa Culture during circa 2300–1750 B. C; the Chalcolithic cultures show a range from circa 1750–1100 B. C.; the P. G. Ware emerges towards the end of these Chalcolithic cultures.

BANERJEE has tried to show that iron appeared in circa 800 B. C. in the cairn burials of the North-West; in the upper levels of the Painted Grey Ware in the North; and in the pre N. B. P. levels of the Central and Deccan Chalcolithic sites. I would submit, however, that in all these areas too the antiquity of iron could be pushed back to circa 1000 B. C.

In the north-western cairn burials the dating has been arrived at on the basis of Sialk Necropole–B affinities. Both SCHAEFFER'$_3$ revised dates and C–14 dates suggest that Sialk VI B is datable to circa 1200–1000 B. C. and not to circa 800 B. C. Similarly the end of the Chalcolithic period in India lakes place in circa 1100–1000 B.C. (as also suggested by B. K. THAPAR) and not in circa 700 B. C. as postulated by the author.

The alleged emergence of iron in the upper levels of the Painted Grey Ware and not in the lowest levels is an anachronism. If the P. G. Ware people did have a knowledge of iron-metallurgy, why should it appear in the upper levels only. People did not wait for centuries (as also pointed out by DESHPANDE) to smelt iron. In fact the recent evidence, especially from Atranjikhera, shows that the P. G. Ware people used finished tools of iron right from the beginning. The only radiocarbon date frem Atranjikhera would tend to show that the P. G. Ware did not start there later than circa 1000 B. C. (though keeping in view the laws of statistical probability so much emphasis should not be laid on the single determination TF–119, 1025± 125 B. C.). All this would clearly show that the emerence of Iron Age in India can in no case be later than circa 1000 B. C.

Questions of Aryan equation have also been raised. I would not try to make any definite equations but would point out to the two major disturbances and movements of peoples in West Asia : the first in the beginning of the second millennium B. C. and the second towards its end. The P. G. Ware people, if at all they came from the West, are possibly asssociated with this second disturbance. To the first disturbance possibly is associated the Ahar Culture.

Gordon CHILDE had said that we should not expect the barbaric Aryans to have possessed a highly developed uniform material culture. They always travelled light and many a time adopted the traits of the vanquished cultures. It was likely that in India they employed Harappa craftsmen also. This would result in an eclectic assemblage of traits, which, in fact, the Ahar culture is. In pottery we get there : painted black-and-red, polychrome, black-on-red, black-on-cream wares, also dishes-on-stand. We find there terracotta humped bulls, Indus type gamesmen, burnt bricks, and copper tools. All these traits may suggest that presumably Harappan potters and smiths survived to work for the new customers,

With the discovery of a black-and-red ware, in a P. G. Ware context in the doab itself, the possibilities of the Aryan equation of Ahar Culture cannot be ruled out. "*Nila-lohita*" can hardly mean painted grey; it can only mean black-and-red ware (as pointed by GHOSH also). Western Asiatic influences in this assemblage further emphasize the exotic strain of the culture.

Radiocarbon dates suggest that the Harappa Culture came to an end in circa 1750 B. C. around which the Ahar Culture emerges on the Indian scene. All this circumstantial evidence does make the equation of the Ahar Culture with people, moving out in the first quarter of the second millennium B. C. quite plausible. Of course, it will remain a speculation till further evidence comes up.

M. N. Deshpande :

I feel there is a contradiction between the statements on pages 193 and 195 respectively in BANERJEE's paper in regard to the association of the Aryans with iron. On page 193 BANERJEE says 'that the Indo-Aryans were, therefore, quite well acquainted with the use of iron before their entry into India. If, however, they brought any iron equipments archaeology is yet to reveal". On page 195, however, he asserts "after all the Aryan invaders had forced their way through the most virile part of the subcontinent with efficient armour of their own, without which the displacement of the once mighty Harappans would have been impossible". Thus in spite of the lack of archaeological evidence an inference is derived and stated with more emphasis than it seems to deserve. Moreover in the present state of archaeological evidence, the contact between the Harappans and the users of the P. G. Ware is not established. It cannot, therefore, be stated that the uses of the P. G. Ware destroyed the Harappans, particularly because the suggested contact between the two is dated to the beginning of the first millennium B. C.

The suggestion regarding the identification of *Nilalohita* of the *Atharvaveda* with the P. G. Ware does not seem convincing.

It is premature to identify the Aryans with the users of the P. G. Ware, to the extent of pin-pointing the equation. In this context, as a guiding principle the criteria of the Aryans as such should first be established from the data available in Vedic literature. The poor 'horse' has been too much played about as a distinctive factor of the Aryans. The horse alone should not be held as the main criterion of the Aryans. Until the criteria are established the attribution of the P. G. Ware to the Aryans would be arbitrary.

BANERJEE has marshalled all his facts beautifully, but I do not agree with the conclusion about the introduction of iron about 800 B. C., in view of the recent evidence from Atranjikhera.

R. C. Gaur :

BANERJEE has put forward two hypotheses; firstly that the use of iron was introduced in India by the Aryans; and, secondly, that the introduction and the spread of the iron industry took place between circa 800–200 B. C. He has sought to justify these hypotheses on the basis of the literary as well as archaeological

evidence. It is difficult not to agree with his agrument that the Harappan, the Ochre-Coloured Pottery (OCP), and the chalcolithic cultures cannot be regarded as belonging to Aryan civilization. Though A. GHOSH considers O. C. P. as the relic of refugee or degenerated Harappans the definite link yet remains to be established. However, there is no apparent evidence to prove that there was even the remotest affinity between the O. C. P. people and the Aryans. Similarly, there is hardly any evidence to indicate that the Chalcolithic people were Aryans; in fact the possibility of a link between these two peoples can be rejected for the following reasons : (a) absence of horse designs in their paintings, (b) lack of definite evidence to prove their ethnic movement from Iran, and (c) the indigenous elements in their culture.

Though at Atranjikhera black-and-red ware has been found just below the P. G. Ware level, it looks as if the two represent quite different cultures. Iron, a common industry of the P. G. Ware phase has not been found so far from this level here. On the other hand, microlithic industry, which is a well-known feature of Black-and-Red ware phase, is quite unknown to the P. G. Ware phase.

Thus the P. G. Ware, the fully developed iron industry, and horse remains seem to indicate adequately that these were associated with the arrival and the expansion of the Aryans as the makers of the Painted Grey Ware. BANERJEE suggests that the word *nilalohita* of *Atharvaveda* stands for this pottery. This, however, is a far fetched derivation, since the word meaning of '*nilalohita*' is simply black and red and it does not indicate anything other than the colour description.

Now if the P. G. Ware phase is to be associated with the Aryans, BANERJEE'S conclusions need reconsideration. The charcoal sample from a mid-level of P. G. Ware phase from Atranjikhera has been dated by C-14 method as belonging to 1025 B. C. Fully developed iron implements occurred in this level as well as in the lower levels. Even if we leave at present the question of assigning an earlier date to the lower levels, we can at least accept that the fully developed iron industry was known in India as early as 1000 B. C.

In the light of this new dating, the views of M. N. BANERJEE and P. NEOGY quoted by BENERJEE may have some force. According to the former the process of iron smelting was known to Rigvedic people and the latter sharing the views of many others thinks that the word (आयस्) '*Ayas*' stands for iron, (but would exclude gold and silver for which separate words existed). Even if this view is taken, there is no reason to believe that the Rigvedic 'people were necessarily unfamiliar with the use of iron.' It seems probable that at a later stage due to the growing demand of iron implements and other articles specialization took place. It then became necessary to distinguish between iron now called *Krishn-ayas* and copper, which was losing its pre-eminence. It would not be out of place to mention here that the iron industry of the P. G. Ware phase is quite different in shape and variety from the 'copper hoard' implements. There is no typological connection between the two, though chronologically the 'copper hoard' culture (if O. C. P. is to be associated with the 'copper hoard' industry) preceded the P. G. Ware Culture.

Banerjee has referred to a blacksmith's furnace exposed at Ujjain in the N. B. P. phase as definite evidence of blacksmith's forge as early as this phase. I may here refer to many circular fire pits of the P. G. Ware phase which are similar to the blacksmiths ' furnace found at Ujjain. In certain cases the opening for introducing the nozzles of the bellows for the fire could clearly be noticed. The numerous vessels lying inside and outside probably were water pots for the use of the blacksmith. Finished tools were found inside as well as outside these furnaces. I am mentioning this only to point out the similarity between the circular fire pits found at Ujjain and at Atranjikhera, though I am still not clear in my mind whether these are pit type hearths or iron furnaces.

In the light of the above-mentioned evidence, the hypotheses of Wheeler and Gordon that the P. G. Ware and iron industry belonged to a much later date can hardly be accepted any longer. Wheeler's idea of associating the P. G. Waie industry with a second wave of Aryan invasion now needs careful revision since its antiquity has gone to a much earlier date. On the same grounds, the dating of iron industry by Banerjee (800—200 B. C.) also needs to be revised.

A. Ghosh :

N. R. Banerjee has comprehensively dealt with and analysed the data on the advent of iron in India, in his paper. I am sure that few observations that I have to make would not detract from the value of the paper.

According to Banerjee, the earliest occurrence of iron may be dated to the eight century B. C. and that it was brought into India by the Aryans. But on all considerations the Arynas must have reached India a few centuries earlier. Until, therefore, it is established archaeologically that iron existed in India earlier than the eight century, the interconnection between the two events is far from established.

I will also like to point out to the dubious value of datings based on uncertain literary evidences. Banerjee has mentioned the authority of B. K. Ghosh in dating the Rigveda to 1000 B. C., a conclusion based on the probable time likely to have been taken for the Ṛigvedic Sanṣkrit to develop into Pāṇinian Sanṣkrit. But it is not possible to lay down any time-scale for linguistic developments; even if it is possible, it has not been worked out in India, where any determination of the time-scale is likely to be subjective to a large degree. As an evidence of subjectiveness, I may refer to the view of Max Muller and, following him, Winternitz, that Buddha had presupposed the whole of the Vedic literature. But this view is without foundation, for where does Buddha, in his recorded preachings, refer to all the ramifications of the Vedic literature ? Similar difficulties remain in the correlation of South Indian archaeology with the Dravidian languages, the earliest reliable records of which date only from the second century B. C. in the form of some primitive cave-inscriptions in Brahmi script.

In this connection, I will also like to refer to the theory of the inner and outer groups of Indo-Aryan languages which had been propounded by Hoerule in the nineteenth century and was followed by Grierson in the early twentieth but, in my knowledge, is no longer considered seriously by present day lingu-

ists. But the obsolete theory has of late been invoked by archaeologists to interpret certain archaeological data.

On BANERJEE's view that the pottery mentioned in the Atharvaveda as *nīla-lohita* might refer to a grey ware, perhaps the Painted Grey Ware, I may point out that a very literal translation of the term would be black-and-red (ware) but I am unable to say how far this would fit in with archaeological theories.

Finally, I may state that the Kausambi inscription mentioning Ghoshitarama occurred on a stone and not on a seal.

S. P. Gupta :

Banerjee's statements on the cairn burials of Baluchistan at three places in his paper imply two things : firstly, the cairn burials are likely to be related to the South Indian megaliths and, secondly, the cairn burials could be one of the sources of the knowledge of iron working to the Indian Aryans represented by the Painted Grey Ware.

To begin with, the first proposition has some obvious difficulties to reconcile with. BANERJEE's arguments are based on some common features met with amongst the cairn burials and the megaliths. They are (i) entombing of post exposure fragmentary bones, (ii) of more than one person put together (iii) in a pit covered by a heap of stones (iv) with provision of a passage corresponding to a port-hole, and (v) some iron implements. Let us examine the validity of each one of these features in the present context.

It is true that the South Indian megaliths mostly contain fragmentary bones, even though the exceptions of extended burials do occur at Maski, etc., yet in Baluchistan cairn burials are of two types, one that entomb fragmentary bones, and two that contain post-cremation bones. Both the types have either copper implements or iron tools or both. The cairn burials of Moghul Ghundai are of the first group and of Sur Jangal of the second group. How can we then generalize this statment in the case of Baluchistan cairns ? Moreover, this feature is not exclusively possessed by the cairn burials and the megaliths. It also occurs with the Neolithic-Chalcolithic cultures at Nevasa, etc. of the Deccan and at Dabar Kot, etc. in Baluchistan.

It is true that the collective bones of more than one person is a dominant feature of the megaliths, (though there are many exceptions both in India and elsewhere), but in itself this feature is not diagnostic for in many other societies where fragmentary burial was practised, collective burial emerged. At Nagarunakonda a Neolithic burial of fragmentary type included bones of more than one person. Some of the urn-burials at Nevasa contained post exposure bones of more than one child. Family ossuaries in caves or rock-shelters are not uncommon amongst tribes even today.

The heaps of stones or cairns are of two types in Baluchistan : (a) non-arranged, i. e. stones are just heaped up over a pit that directly contained bones or the bones were put in a pot in this pit and (b) arranged, i. e. stones are put one over the other forming a solid walled tower either round or rectangular with flat top.

In the case of the cairns in South India, the arrangement differs : when it is disarranged, normally it is supported by a circle of stones, a feature not at all common with the cairns of Baluchistan and, when it is arranged, as at Brahmagiri, it entombs a cist, mostly with the port-hole and it is arranged in concentric walls with the intervening area filled in with rubble stones.

It is true that a passage in a tomb could have served the same purpose as a port-hole in a megalith but it is not the functional aspect that is diagnostic of the megalithic culture's port-hole: it is the actual making of a port-hole as a part of a megalith structure that is diagnostic. It is more so in the case of those burials which are not otherwise typically megalithic or which do not exist within the big complex of the megalithic monuments. The argument may be valid in the case of Sanur megaliths excavated by BANERJEE on grounds of ' implication ' of co-existence of port-holed and nonport-holed types in the southern region, just as we can include the Cochin caves under megalithic type on grounds of implication of megalithic Black-and-Red pottery found in them, but it cannot be valid in the case of the cairn burials of Baluchistan since it cannot be proved even on grounds of any implications whatsoever.

The last point is the association of iron which, to my mind, means very little except that both the cairn burials and the megaliths in India belonged to the Iron Age. It can only get a meaning when their tool-types are identical. I am afraid, it is not so. The examples of spear-heads and arrow-heads quoted by BANERJEE are from the cairns of Moghul Ghundai for purposes of comparison but they differ from the megalithic types in two significant ways : firstly, their blades are more or less logenze-shaped as against the leaf-shaped of the megaliths and secondly, their tang is of ' double tanged ' variety of the Śakas and Hunas found at Taxila and Kausambi while the megalithic types have socketed tang or a simple solid tang, never double-tanged variety of a tang. The tribolate type of blade from Moghul Ghundai seems to be of three flanged type of the early centuries of the Christian era.

Over and above these points I would like to mention that in distribution, the cairn burials and the megaliths are mutually exclusive. The former extends from Baluchistan through southern Iran to southern Arabia where no megaliths have been found. The evidence of port-holed cist near Karachi has already been rejected by Sir Mortimer WHEELER. And then, there is neither a cairn nor a megalithic site between Baluchistan and Central India.

In fact, when we talk of megaliths in the European context, we actually mean dolmens, menhirs, alignments, port-holed cists, etc. As I said earlier other types are megalithic types only by implication of the association of dominant types and not independently. It is precisely the reason why recent intensive researches on this problem in Denmark have established an independent origin of many of the so-called megalithic types.

The second implication of BANERJEE's statement needs more evidence. What tangible evidence is there that it was a source of the knowledge of iron-working to the Painted Grey Ware Aryans except that the former may be dated to circa 1000–800 B. C. because of the Londo Ware association and the latter to

to circa 800 B. C. or so, i. e. the priority or contemporaneity ? However, we now know that the Painted Grey Ware with iron implements at Atranjikhera in U. P. is dated circa 1100 B. C. and it is more than probable that the Baluchistan phase of Aryan migration has to be dated, at least, between circa 1300 and 1200 B. C. when the cairns did not exist. Moreoever, the cairns both in southern Arabia and in Baluchistan are dated to a period extending from circa 1000 B. C. to circa 100 A. D. and not confined to circa 1000–800 B. C. In fact, it is still a living practice. We have, therefore, to be very specific while quoting sites since they are of different dates.

B. K. Gururaja Rao :

A. Ghosh is of the opinion that the earliest date assignable to Tamil is first or second century B. C. when some Brahmi inscriptions in Tamil exist. But the antiquity of Tamil goes back to a considerably earlier age. The Sangam literature is ascribed to early Christian era (100–250 A. D.) by scholars like Nilakanta Sastri and S. Vaiyapuri Pillai. The language and style of this literature presuppose a considerably long period of development. Banerjee has said that the antiquity of Tamil must be taken back to at least third century B. C.

Moreover an early Tamil grammar, *Tolkappiam*, the earliest work of its kind in Tamil, is assigned, at the latest to the third century B. C. It goes without saying that a language must have been in use for some considerable period before an attempt at systematising its grammar is made and hence the antiquity of Tamil must be considerably earlier than third century B. C., say at least two centuries earlier.

Further, a large number of scholars are assuming, on circumstantial evidence that the South Indian megalith builders must be eguated with the Dravidian or Tamil speakers and the megaliths are assigned to fifth century B. C. or earlier On this ground also Tamil dates back to at least fifth century B. C.

Banerjee considers that iron was introduced by the Painted Grey Ware people around 800 B. C. probably obtaining it from Sialk VI people of Iran or from the cairn builders of the borders of Iran and Pakistan. But the occurrence of iron at Atranjikhera in association with the P. G. Ware, assigned to 11th century B. C. by C-14 test, takes back the antiquity of iron in India, anterior to the Sialk VI period.

We know that Hittites guarded the secret of iron technology and when their power was shattered by the Assyrians on the one hand and the 'Sea people' on the other, the Hittite smiths dispersed and diffused this knowledge in different directions in the twelfth century B. C. and we know that these, 'sea peoples', the Syrians and the Palestinians were in touch with India at that time. So it is possible the knowledge might have entered India in the course of this diffusion at this period without the intervention of the Sialk VI or other Iranian people.

Kenneth A. R. Kennedy :

It is an irony that the physical anthropology of the Iron Age peoples of India is today so little under: tood in view of the many skeletal remains which Iron

Age sites have yielded to the archaeologist. Indeed, the racial characteristics of Chalcolithic-Bronze Age skeletal specimens have provided more certain data concerning the genetic composition of ancient India and Paskistan. There are only three Iron Age sites whose human remains have received particular attention—Jiwanri, Adichanallur, and Brahmagiri. LAL has kindly called to my attention the recent but very brief account of six skeletons from Yelleswaram. Two more specimens from this site have just been recovered and these I was able to examine through the courtesy of Abdul Waheed KHAN of the Department of Archaeology, Andhra Pradesh.

If we are to determine the racial composition of these Iron Age peoples, archaeological research must be organized with the intention of securing skeletal remains for anthropometric and bio-chemical study. Proper methods for preserving this valuable material must be initiated, for in the past the bones have received inadequate care upon removal from the site. Many more specimens have become lost in museum collections due to the lack of sound cataloguing procedures.

The craniometry of these later prehistoric specimens indicates an increasingly high frequency of brachycephalic skulls.

R. N. Mehta :

Many Iron Age sites have been known from Coastal Gujarat. The earliest phase of iron at these sites could be divided in the following categories on the basis of the evidence of associated finds.

I. Sites like Nagara, Timbarva, Broach, etc. belong probably to the later half of the first millennium B. C. Some iron is discovered at these sites in association with the Black-and-Red Ware, N. B. P. and other related wares.

II. Other sites like Baroda, Shamlaji, Vastan Dungri, and Vadnagar mostly belong to the early historic period beginning from the first century of the Christian era. At these sites iron is found in association with the R. P. Ware, Coarse Red-and-Black Ware, Painted Ware and other wares of this period. Sites like Vastan Dungri show evidence of smelting.

III. Vasravi, Kapadwanj and other smelting sites show the remains of iron smelting, but the evidence of the associated pottery, such as Muslim glazed ware, plain red were, plain black ware, etc. suggest that they belong to the Medieval Period.

From the sites of Category I, along with iron objects a large number of bone implements have been discovered. Do they point out that at this time (1) iron was newly introduced and was in the incipient state ? (2) the older tradition was continuing ? or (3) both possibilities should be considered ?

The difference in the chronological position of the Iron Age material when compared with the other parts of India suggests that it is due to two reasons : (i) differential development of Iron Age in India, and (ii) less work.

P. C. Pant :

By quoting various authorities BANERJEE has tried to take '*ayas*' in the sense of iron and consequently to prove the high antiquity of this metal in India.

But the meaning of '*ayas*' is never clear in literature. If '*ayas*' can be taken for iron, it can also mean other metals like copper. So I would only submit that occurrence of the word '*ayas*' in *Veda* need not be taken as an indication of the use of iron in India in such a hoary past.

Secondly, I would like to say a word about the date of Northern Black Polished Ware. Throughout his paper, BANERJEE has referred to circa 600 to 200 B. C. as the date of N. B. P. It has become the general tendency of present archaeologists to give similar date to this ware, wherever it is found. I feel, while giving the date, we must take into consideration the area where this ware has been discovered. I think, east Uttar Pradesh and west Bihar are actually the tresure-house of the N. B. P. Ware where the occupational deposit of this ware ranges from about ten feet to fifteen feet or so. This area may also probably be regarded as the original home of this ceramic industry. So, for the purpose of dating, we should make a difference between the N. B. P. discovered in Central India, Deccan Western India etc. and in east U. P. and west Bihar.

Y. D. SHARMA in his comments made reference to the Black-and-Red Ware of Prahladpur, District Varanasi. He said that this ware has been found there with N. B. P. and is also associated with iron. I am afraid this statement of SHARMA is inaccurate. There is a definite Pre-N. B. P. phase at Prahladpur and Black-and-Red Ware associated with Black-slipped Ware are characteristic ceramic industries of this phase, though the former, in a limited quantity, also continues in the succeeding N. B. P. phase. This sequence is very clear at Rajghat. I may also add that iron is associated with N. B. P. phase and not with preceding one at both the sites.

BANERJEE writes "the later Vedic people among whom the practice of collection of calcined bones, their incarceration in an urn under a mound surrounded by a circle was known". I am afraid this statement is also inaccurate. A detailed description of post cremation burial (Smaśāna) is given in *Sātapatha Brāhmaṇa* and *Pitrimedhasutra*. But nowhere is there any reference to an urn burial surrounded by a circle in either of these works. *Śatapratha Brāhmaṇa* simply records two traditions–one of the worshippers of gods (Vedic) and the other of the Asuras, Easterners and the like people (non-Vedic). It further says that the former made their burials four cornered and the later round. In case of the former tradition, the work prescribes that after cremation of the body, the bones should be collected in a pot and deposited in the earth under a tree. After the lapse of a considerable time, it should be unearthed and the bones should be poured in the four cornered burial, made of stones. It should be noted that actual pot was never kept in the burial. Then it should be covered by stone rubble. Let me also inform you that the megaliths of Banimilia-Bahera, in Mirzapur District explored by us to a great extent agree with the description given in *Satapatha Bāahmaṇa*.

H. D. Sankalia :

Dr. N. R. BANERJEE's paper is quite comprehensive, as it surveys almost all the points bearing on this problem. But on one point, however, I find that BANERJEE has unnecessarily taken a very rigid attitude and that is the relation of

the Painted Grey Ware to the Aryans and the dating of the arrival of the Aryans. When the Aryans were dated to about 1200 B. C. by MAX MULLER, he had very cautiously said that he was suggesting the minimum date to the people who composed the *Ṛgveda*. Afterwards WINTERNITZ suggested that the date could not be 1500 B. C. or so. Recently I had occasion to study the entire literature on this to Pic and I found that there was no unanimity on this point and, therefore, it was not necessary at all to assume that the Aryans arrived in India only in 1200 B. C. and not earlier. I, on the contrary, suggest that we should assume a more flexible position, changing our position as the facts require. For instance, the Painted Grey Ware itself is now dated to about 1200 B. C. If this was the date of the arrival of the Aryans, then at least some time will have to be allowed for them to enter Afghanistan or Baluchistan, then their migration to Punjab and then to the Ganga-Yamuna doab. If we do not stick to the date of 1200 B. C., then we can explain the position of the Painted Grey Ware, and its relation to the Aryans much more satisfactorily. If the people of Central India as illustrated by Navdatoli and other sites, were some people from Iran, then naturally we have to think that the people from Iran, who may or may not be Aryans, must have arrived here at least five to six centuries earlier. In that case the people who brought the Painted Grey Ware and the iron will be some later group from Iran or Western Asia. I would, therefore, plead for a broader outlook on this problem,

B. K. Thapar :

Dr. BANERJEE has postulated a date of circa 800 B. C. for the introduction of iron in India. The Ganga plains, according to him, seem to be the first to adopt and develop its use. In support of this hypothesis he has collected both literary and archaeological evidence. The former along with the controversial question about the Aryans and their immigration into India has already been commented upon by GHOSH and SANKALIA and has of late been discussed with varying points of view by other scholars (SINGH, 1962; GOPAL, 1963; KOSAMBI, 1963). This stimulating essay may not carry conviction with some archaeologi ts who are wont to put more reliance on objective evidence alone. Two such dates would perhaps satisfy them : (i) latter part of the sixth century B. C., the knowledge of iron being introduced into the north-western plains of the subcontinent by the Achaemenid conquerers when extending their empire into the region; and (ii) 1025+110 B. C. being a C-14 determination of a sample from the iron-using Painted Grey Ware levels at Atranjikhera. The range of 800–700 B. C. for the introduction of iron in the sub-continent thus remains a postulate. It was hinted over a decade ago by GORDON (1950) but, unsupported as it was by any real archaeological evidence, he considered it as purely speculative.

Let me now draw attention to the applicability of these dates in the general time-scale of the Indian cultural kaleidoscope.

On the basis of C-14 determinations from Hastinapura, Kausambi, and Rajgir, the beginning of the Northern Black Polished Ware cannot be placed earlier than 455 B. C. (reckoning one standard deviation), the empirical date being

century or so still earlier. Taking this as an objective evidence, the occurrence of iron at those sites where its use commences with the appearance of the N. B. P. Ware, cannot be postulated earlier than 455 B. C. Recent excavations at Chirand Prahaladpur, Rajghat, Sohagaura and Sonpur have clearly indicated the existence in the middle Ganga plains of a distinct cultural horizon prior to the advent of iron and the emergence of the N. B. P. Ware. Demonstrably, therefore, this pre-iron culture characterized by the use of the Black-and-Red Ware, occasionally also white-painted, is earlier than 500 B. C.

Coming to the Upper Ganga-Yamuna doab we find that the use of iron is associated with the Painted Grey Ware. At the former site, iron in the form of slags and lumps of ores was found in the uppermost levels of the P. G. Ware strata which are dated by C-14 determinations to a range between 390+115 to 335+115 B. C. The controversy over the initial date of this Ware does not concern us here. At the latter site, iron was found from the very start of the P. G. Ware settlement, for which an objective initial date by C-14 determination comes to 1025+110 B. C. The Painted Grey Ware stratum at this site is preceded (with an overlap) by a Black-and-Red Ware using occupation, which by inference of the above-mentioned date, would thus be earlier than 1025±110 B. C.

Turning to Western and Central India we find that the Chalcolithic cultures—Ahar, Navdatoli and Jorwe—had come to a close by circa 1000 B. C. as shown by a series of C–14 determinations (barring the two erratic ones from Nevasa and Eran) from Navdatoli, Nevasa, Chandoli, Ahar, and Eran. The succeeding occupation marks the advent of iron along with the use of the Black-and-Red Ware. The knowledge and exploitation of iron in this region as in the upper Ganga-Yamuna doab preceded the appearance of the N. B. P. Ware. A contemporaneity of some phase of the iron-using P. G. Ware and the Black-and-Red Ware is thus suggested. Much discussion, however, revolves around the question of the origin of this Black-and-Red Ware. What relationship does this ware, associated as it is with the use of iron, bears with the technically similar ware of the pre-iron assemblage in the Ganga-Yamuna doab and the middle Ganga plains remains elusive.

In Central India and Northern Deccan, a gap is postualted between the end of the Chalcolithic occupation and the beginning of the early Iron Age settlement. Since the terminal date of the former is well-defined (circa 1000 B. C.), the duration of this gap is dependent largely on the date for the introduction of iron in this region. Hypothetically, the latter is placed around 600 B. C. with the result a gap of about four hundred years or more, evidenced at some of the excavated sites in this region, remains unexplainable in terms of historical evidence. If the solitary evidence of an overlap between the two cultures, viz. Chalcolithic and Iron Age (Sankalia, Subbarao, and Deo, 1958, 21) has any indication, the introduction of iron in this part of the country may be not much later than 1000 B. C. This would perhaps be consistent with the findings at Atranjikhera. This evidence, circumscribed by the limited data must necessarily be considered as highly provisional. Before any definitive conclusions are drawn, therefore, further confir-

matory objective evidence is necessary. The problem does not seem to have been solved with this equation. Since no break between the occupations of the Black-and-Red Ware and the N. B. P. Ware is evidenced at any of the sites in the middle Ganga plains (Chirand, Prahladpur, Rajghat, Sohagaura, Sonpur, etc.) it becomes apparent that the latter (without the use of iron) continued up to the middle of the fifth century B. C., being the primary date for the production of the N. B. P. Ware within the doab. This differing time-value does not fit in with the developments in the Upper Ganga-Yamuna doab or Central India. The application of this date to the megaliths both in the Mirzapur region and the Peninsula poses more problems.

Concluding Remarks by N. R. Banerjee :

The tentative position put forward by me that the users of the Painted Grey Ware were Aryans, and it was they who introduced iron into India has been objected to by several scholars on different grounds. These include D. P. Agrawal and M. N. Deshpande.

Agrawal makes a distinction between two waves of Aryans, and has no objection to the second wave of Aryans represented in his opinion by the users of the Painted Grey Ware, as being responsible for the introduction of iron, though he would assign an earlier date, on the basis of carbon–14 assessments, to its beginnings in India.

Agrawal has based his comments on the chronological data as revealed by the C–14 studies, and they are so much at variance with the empirical dating.

He is inclined to think that since the Harappa Culture came to an end around 1750 B. C. and the Chalcolithic culture of Ahar begins about this period, the latter must be held tentatively as the first wave of the Aryan immigration into the country. This culture again ends about 1100 B. C. and catches up with the Painted Grey Ware, which is to be attributed provisionally to the second wave of Aryan movement. As Atranjikhera has shown the occurreence of iron objects from the lowest levels of the Painted Grey Ware, there cannot be any doubt that the Aryans, of the so-called second wave, as suggested by Agrawal, used it from the very beginning.

The position regarding the Ahar Culture being the possible result of Aryan immigration has been described by Agrawal himself as speculative. But the dating of the end of Harappa to circa 1750 B. C. create a problem in the region of early Aryan habitat, i. e. in the Indus Valley itself as amply indicated by the *Ṛigveda* of the absence of any contact between the two, which is not resolved. In this connection the view expressed by A. Ghosh that the obsolete theories of Hoernle and Grierson about the Inner and Outer groups of Aryans are being revived by some archaeologists without adequate documentation deserves consideration.

The author has pointed out that the phenomenon of the occurrence of several cultural traits, apparently disjointed, and limited in distribution in the post-Harappan phase points to what Wheeler has described as 'cultural frag-

menation.' He has further called these fragmentary cultures as the 'beggarly successors' of the mighty Harappans. These were probably the relics of the several cultures which shared in the invasion of India and would account for an interregnum prior ultimately to the successful exploits of the widespread users of the Painted Grey Ware in the cradle land of Aryan civilization.

DESHPANDE, on the other hand, questions the very equation of the users of the Painted Grey Ware with the Aryans, and he does not agree on the date of 800 B. C., suggested by the author, provisionally, for the introduction of iron in India. He also refers to a contradiction between some of the author's statements.

DESHPANDE would not also attach any importance to the apparently negative evidence of the absence of finds of iron objects from the earlier days of the Painted Grey Ware, even if it were to be attributed to the Aryans.

It may be pointed out in reply that there cannot be any doubt that the Aryan invaders must have had some armour even of iron, as there is evidence to show their acquaintance with it before their immigration into India.

As to the evidence of an earlier date for the emergence of iron in the doab itself, and for that matter in the country as a whole, as also emphasized by R. C. GAUR and AGRAWAL on the basis of the latest find at Atranjikhera, it may be stated that it lends further support to the theory advocated by me, though this evidence was not known at the time of writing this paper.

The former absence of finds of iron objects in the earlier levels of the Painted Grey Ware was an archaeological gap which the evidence of Atranjikhera has now considerably filled up.

The apparent lack of any evidence of contact between the Harappans and the users of the Painted Grey Ware no doubt poses a problem in archaeology as also the implied chronological incompatibility. This might call for a change in our assessment of the causes of the decline of the authors of Harappa but it does not change the date of iron, suggested by me, very considerably, nor its source.

DESHPANDE makes a plea for laying down of the material criteria of the Aryans, before any pin-pointing could be done. It would certainly be a very desirable course to adopt, if it were practicable. But, for the present, such a definition remains a problem.

The attribution of the Painted Grey Ware to the Aryans is, however, provisional and tentative and, in view of the available evidence, seems to be the most plausible interpretation that can be offered in the present circumstances.

A. GHOSH concedes the equation of the users of the Painted Grey Ware with the users of iron but makes the point that the connection between the Aryans and iron cannot be established till it is proved archaeologically that iron occurred earlier than 800 B. C., the date indicated by the authour. The recent evidence at Atranjikhera referred to above, however, points in this direction.

Nevertheless, the Aryan question cannot be said to have been fully solved.

It is correct, as pointed out by GHOSH that the date arrived at for the composition of the *Ṛigveda* namely, circa 1000 B. C. is subject to revision and not sacrosanct. Nevertheless, one cannot get away from the present uncertain position in the matter, and have some regard for the views and arguments of B. K. GHOSH.

The view held by GURURAJA RAO that iron, on the basis of the evidence at Atranjikhera, emerged earlier in India than in Sialk VI B cannot be held as strictly correct, as the carbon date itself allows a margin, which may very well put the iron of Atranjikhera much later than at Sialk VI B. The point that Sialk VI B people could not possibly transmit iron to India does not seem to be correct either, on the same grounds as stated above.

S. P. GUPTA has entered into the field of controversy by raising objections in regard to two aspects of my theory viz. (i) the connection between the cairn burials of Baluchistan and the megaliths of south India and (ii) the connection between the iron objects in the cairns and those of the Southern megaliths, besides their connection with the Painted Grey Ware.

As to the first objection, the points of similarity between the two have been already indicated by me and what has been expressed is a strong possibility, which the personal views of GUPTA has not eliminated. It may be further pointed out that absolute similarity between the two cannot really be expected nor all types found in the megaliths be expected in Baluchistan. The feature of the post-cremation fragmentary burial is also available among the megaliths. It is true that the circle is not found around the cairns but it may be pointed out that circles are not found around entombing urns or sarcophagi among the megaliths in the Chingleput District. At Brahmagiri itself there are cairn-like enclosures, which are themselves not individually enclosed by circles.

GUPTA's point about the port-hole is unacceptable, especially in view of the recent discovery of port-holed dolmens in this region as reported by FAIRSERVIS (communicated to me in correspondence by Professor HEINE-GELDERN). This also seeks to answer the point that megaliths and cairn-burials are mutually exclusive.

As to the independent origin of megaliths in India in general, GUPTA has not quoted any evidence, except his personal feeling or the distant parallels in Denmark. There cannot be any doubt that many of the types in India are local in evolution in response to environment and topography within the broader general megalithic concept.

As regards the types of iron objects in the cairn burials being different from those in the megaliths, the statement is premature and based on inadequate evidence. The tool types are so general and few that a real comparison is not possible. The trilobate type is unique, but its suggested dating as asserted by GUPTA, is not acceptable in view of the circumstances of its discovery, stated below. Nevertheless, the general type of arrow-heads cannot be said to be fundamentally different from those in the megaliths.

GUPTA had also pointed to Arabia as the possible source of the cairns in India (though this point is not clearly stated in the written comments). This goes against his own theory of independent origin while the primary premise itself remains to be examined.

It has never been suggested by me that the users of the Painted Grey Ware may have owed their iron to the cairn burials of Baluchistan. The position stated is that the megalith-builders of south India may have obtained their knowledge of iron from the cairn burials or from the users of the Painted Grey Ware in the northern plains or from both.

As to the Baluchistan phase of Aryan immigration, the less said the better, as it is an entirely groundless theory based on speculation.

As to the date of 100 A. D. applied to the cairns of Moghul Ghundai, one has to be cautious in view of the incredible speed of Sir Aurel STEIN's excavation methods, which in his own words, accounted for one hundred and seventy-eight cairns in the course of four days' strenuous work.

The point made by A. GHOSH about the difficulty of correlating South Indian literary tradition with archaeological data is a word of caution against any hasty oversimplifications regarding the megalith question.

The author is in agreement with P. C. PANT that *ayas* lends itself to diverse interpretations, but it does not, however, rule out iron.

Though PANT would insist on precise dates of the N. B. P. Ware and its associated cultural milieu in different regions, the date of the N. B. P. Ware adopted for discussion forms the inclusive range, no doubt for convenience and broad generalization, in view of the absence or paucity of specific dates.

As to the method of interment of calcined bones mentioned in later Vedic literature, in respect of which PANT seems to think that they do not refer to the megalithic disposal of the dead as practised in South India, I would quote P. V. KANE (1953, 23). "Besides, after the charred bones were collected they were placed in an urn or pot which was buried in the ground, and after a good deal of time a mound (Ṣamśāana) was built upon the bones as will be seen immediately from a passage in the *Ṣatapatha Brāhmana* and other sources". We may also consider a passage on P. 248 of the same publication which reads as follows :—

The *Sat. Br.* (XIII, 8. 2-4) pursues the subject of sepulchral monuments as follows : "Godly people make their sepulchral mounds so as not to be separate from the earth; while those who are of the Asura stamp, the Easterners and others, make the sepulchral mounds so as to be separate from the earth either on a stone basin or a similar thing. We then enclose it with an undefined number of stones silently."

As to relating the megaliths in Mirzapur to the description of the *Ṣathapatha Brahmaña*, as suggested by PANT, it may be stated that the stage is apparently premature.

Several scholars, have raised an objection to my translation or interpretation of *nila-lohita*. Let me state that I have no more than tentatively suggested that the word may refer to the Painted Grey Ware. If it is taken to mean Black-and-Red Ware, it would present the difficulty of translating *nila* as black. Even if it were taken to mean the Black-and-Red Ware, it is not to be wondered at since this ware was perhaps commoner than the *de luxe* Painted Grey Ware, and it has already been pointed out that the immigrants could not be expected to bring pots and pans of their own but adopted and adapted local ceramic wares for domestic use.

The author acknowledges with gratitude the correction pointed out by A. Ghosh of the nature of the Ghoshitarama inscription.

NOTES

1. Information from Dr. Y. D. Sharma.
2. Various excavation reports and connected articles.
3. Information from Shri B. K. Thapar.
4. Information from the Director General of Archaeology in India.
5. Information from Prof. Heine-Geldern.
6. Information from Prof. Heine-Geldern.
7. Information from Shri K. R. Srinivasan. Also see Srinivasan in a *Comprehensive History of India*, Vol. II, (The Mauryas and Satavahanas). 1957, 724.
8. As a cultural entity, the 'copper hoards' are engimatic, though the position is now much clearer than before.
9. Sharma Y. D., unpublished paper on 'copper hoards' and Ochre-Colour Ware in the Ganga basin, First International Conference on Asian Archaeology, 1961.
10. Information from Shri M. N. Deshpande.
11. It occurs in the inscription in the plural form ending in *na*.
12. Marutash (Marut) or wind was also another deity among the Kassites.
13. This indicates that the bifurcation of the Iranians and Indo-Aryans was not very far removed from this date.
14. A recent excavation in Persian Azerbaijan has led to this conclusion.
15. The Thraco-Phrygian invasion from the sea into the mainland of Asia Minor put an end to the second Hittite empire forcing the Hittites to flee to Syria.
16. Ziemmer translates *'nil lohita'* as dark-red.
17. As noticed by the author among the pottery from the 1940–44 excavations.
18. From the unpublished report of excavations by the author.
19. Observations by the author during the excavations in 1955–58.

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TRADITIONAL INDIAN CHRONOLOGY AND C-14 DATES OF EXCAVATED SITES

H. D. SANKALIA

This is an essay in speculation. It is thinking aloud about some of the old problems. Of course, most European scholars might counter by asking "Is there evidence at all for re-opening the old question ? Why worry about the Vedas and Puranas when we cannot date them, and when archaeology has not given a scrap of evidence for proving their genuineness ?" In a sense these objections are valid, but things are not as they were, say twenty years ago. Excavations in several parts of India–the Gangetic Valley, Chota Nagpur Plateau, We t Bengal, Central India, Rajasthan, Saurashtra, Maharashtra, Andhra and Mysore have shown that many of the so-called historical sites are situated on still older habitations–towns or villages; e. g. Nasik, Nevasa, Bahal, Prakashe in Maharashtra, Maheshwar, Nagda, and several in the Chambal-Narmada valleys; Hastinapura and others in the Gangetic doab; Ahar, Gilund etc. in the Banas valley in Rajasthan; Rangpur, Rojadi, Somnath etc. in Saurashtra and Brahmagiri, Sanganakallu, Maski, Tekkalkota, Piklihal and many others in Andhra-Mysore; Rajar Dhibi, Sonpur etc. in Bengal and Bihar; Taxila and Charsadda in West Punjab. Now some of these places or regions happen to have ancient names derived either after the inhabitants or from the tribes and ruling dynasties that are mentioned in the epics, Puranas, Jaina and Buddhist literature. When nothing of the antiquity of these places was known, we had no means to check certain puzzling facts, for instance why the ancient people of Nasik were called Nasikyah by Patanjali when the place was not known to be so old? So also with Hastinapur, Maheshwar and many other places.

Now not only do we know that these places and regions are old, but with the help of the C-14 dates some idea of the time can be had when these places or peoples might be existing. Furthermore, a study of their material culture helps us in looking for their affinities with other cultures in or outside India. So with these aims in view some likely relationships between sites or cultures revealed by recent excavations and names of peoples, tribes and dynasties are here suggested.

All that we know from C-14 dates is presented by B. B. LAL (1963; 208) After his article was published, a few more dates have been available. These dave also been considered here.

The C-14 dates discussed by LAL have been based on 5730 + 40 as the half-life value of the radio-carbon and the reference year adopted for converting hates from years B. P. to B. C. is A. D. 1950.

Some sites have a number of dates, but since we are concerned with the probable time when the site was in existence, the earliest date out of many or

whatever date is available in the case of single determination is here given region-wise beginning with the earliest and from north to south.

1.	Baluchistan (Kili Ghul Mohammed)	3690 ± 85 B. C.
2.	Sind, Rajasthan, Gujarat (Indus Civilization, including its earliest manifestation called Kot Diji)	2650 ± 145 B. C.
3.	S. Rajasthan (Ahar or Banas Culture)	1725 ± 140 B. C.
4.	Central India (Eran and Navdatoli)	2035 ± B. C.
		1645 ± 130 B. C.
5.	Maharashtra (Nevasa-Chandoli)	1330 ± 70 B. C.
		1255 ± 115 B. C.
6.	Andhra-Mysore (Utnur)	2295 ± 155 B. C.
7.	Chota Nagpur plateau and West Bangal (Pandu-Rajar Dhibi)	1012 ± 120 B. C.
8.	Ganga-Yamuna Valley (Painted Grey Ware-Atranjikhera)	940 ± 105 B. C.
		{ 940 + 105 B. C.
		{ 1020 + 110 B. C.
8a	Hastinapur	505 ± 130 B. C.
9.	Kashmir (Burzahom)	1850 ± 130 B. C.

With regard to the accounts from the epics, Puranas, etc., there are many difficulties. The accounts are often contradictory. Scholars have therefore deduced chronological lists which vary greatly in time range. For the sake of convenience, we may call these Long Chronology, Medium Chronology and Short Chronology.

Some of the most important writers on this subject are TILAK, DAS, DUTT, PARGITER, PRADHAN, SENGUPTA, RAYCHAUDHURI, PUSALKAR, ALTEKAR, MANKAD and BHARGAVA. For our purpose it is not necessary to examine the views of all these scholars here. TILAK and DAS may be dismissed immediately, for they are the protoganists of extraordinary long chronologies, which do not serve our purpose at all, placing as they do, if accepted even provisionally, the Vedic Aryans to a period of about 10,000 B. C. : that is, archeologically to the end of the Ice Age and the beginning of the Holocene, that is, to a real Stone Age period.

All the rest base their calculations on the determination of the date of the Bhārata war. This has been variously dated viz. 3102 B. C., the traditional beginning of the Kali Yuga, and three others around 3000; 2449 B. C. according to astronomical calculations . 1400 B. C., 1197 and 1151 B. C. and 950 B. C. (PUSALKAR, 1957, 316)

Of these, RAYCHAUDHURI (1938) might be taken up first. He has carefully analysed the Vedic literature (Early, Middle and Late), and tried to reconstruct political history, primarily of northern India, before the 6th century B. C. He has used the Puranic as well as the Jaina and Buddhist data only where these corroborate the Vedic. But on the whole he regards the Puranas as unreliable.

The sheet anchor of RAYCHAUDHURI's as well as PARGITER's (and many others) is the Bhārata war, and the accession of Pariksita. For these RAYCHAUDHURI suggests (p. 44) two dates, either 14th century B. C. or the 9th centruy B. C. The Vedic Janaka correspondingly would be placed in the 12th or 7th century B. C. Thus according to RAYCHAUDHURI also we shall have a longer and a shorter chronology.

Accepting the first, viz. the accession of Pariksita in the 14th century B. C., we have about a century in which to place all the events of the Vedic period, viz. the arrival of the Vedic tribes from outside, wars among themselves, as well as with the Dasyus and Dasas and expanison eastwards and southwards.

The Vedic tribes were first settled in the Punjab; the Bhārata war took place in Kuruksetra. The centre of political activity gradually shifted to esatern India, the states of Vasa or Vatsa, Kasi, Kosala, Magadha, and Videha became more and more prominent and powerful, the ancient Kuru kingdom falling into insignificance. That is, by the 12th century B. C., according to this calculation, the whole of eastern India upto and including Bihar was politically and culturally a distinct entity, with various ruling kings who might have descended from the Purus or Bharatas, if the Puranic evidence is to be believed.

And all the later development from Janaka to the rise of the 16 Mahajanapadas in the 7th—6th century B. C. took place during some five to six centuries.

If, however, we accept the shorter chronology, with the Bharata war around 1000 B. C., then both these things (1) the rise to prominence of the eastern states etc. after Pariksita and Nicakru, (2) the age of Janaka and the subsequent development—would be assumed to have taken place in two centuries or less.

With regard to the reference in the Purānas to the colonies of the Yādavas and their sub-branches in the Narmada valley, and Vidarbha, since the Yadu tribe as well as the tribes of Turvasu, Druhyu and Anu also appear in the Rig Veda, RAYCHAUDHURI thinks that this tribe might have been an earlier Aryan one which was later pushed out by the Magadhas and Kurus from Mathura. RAYCHUDHURI further points out that according to one Ṛig Vedic reference the Yadus had come from a distant land and that they were associated with the Parsus or Persians (*Ṛigveda*, VIII, 6, 46) (*PHNI* 117.).

ALTEKAR (1939, 35-57) has gone a step further than RAYCHAUDHURI. He has shewn that there are quite a good many instances where the Purāṇic incidents and names of kings occur in Vedic literature and therefore in such cases at least the Purāṇic accounts can be believed.

He again dates the Bharata war to 1400 B. C. and counting backwards by assigning 15 years to each generation places :—

i. the early Vedic period in 2700 B. C.—1500 B. C.
ii. the Middle Vedic Period (Brahmanas) in 1600 B. C. 1000 B. C.
iii. the Late Vedic (Upanisad) period in 1200 B. C.—600 B. C.

The most important conclusion of his study from the point of view of our discussion is that the whole of North India, including Kosala was Aryanized by 2700 B. C. and Northern Deccan before the time of Bhima of Vidarbha, that is

the 22nd century B. C. It is for us to see how far these conclusions can be accepted, that is whether they fit in with the archaeological data at our disposal.

But I must repeat that if we do find any clues, in our data, then the further conclusions of ALTEKAR and others are worth testing both by Puranic and archaeological studies (including excavations, that is selecting those sites for excavation, which are mentioned in Vedic and Purāṇic literature and satisfactorily identified).

Consequences of accepting the long chronology need not be discussed. For as mentioned below, our responsibility increases as the gap between the known and the unknown widens. Excepting the traces of the Harappan civilization in Western India and the Punjab, Rana Gundai IIIc culture found under the debris of Harappan and the low level of (minus 32 feet) Mohenojodaro might be placed to a period before 2500 B. C. nowhere in India have we got any cultures going back to a period before 2200 B. C., unless the so-called ochre-washed pottery from U. P. turns out to be a relic of the Harappa Civilization itself in this region.

Let us now see what archaeology has to say on these political and tribal "stratifications".

Excavations at Hastinapur and elsewhere in the Gangetic valley definitely indicate two periods First, the Period of the ochre-washed, second the Painted Grey Ware.

The Painted Grey Ware was *provisionally* attributed to the Early Aryans; by this we understand the Vedic Aryans, their first phase ending with the Bharata war, about 950 B. C. thought the C—14 dates fronm Hastinapur for the Painted Grey Ware are late, the one from Atranjikhera is quite early, and corroborates the dates arrived at by LAL from other considerations.

Accepting provisionally the attribution of the Painted Grey Ware to the Aryans, we shall or might have to go a step further and say this represents the cultures of the Purus, Bharata or the Kurus. And the more eastward we go, not only the associated pottery might change, but other details of culture (material) as well. The details are not known well, nor the C-14 dates of these cultures, but things different from the Painted Grey Ware are coming forth.

However, matters are not so simple as that. Sites like Rajar Dhibi in the Ajay valley have revealed a culture existing in all probability before the Painted Grey Ware. For the moment we shall call it pre-Aryan.

Within the Gangetic Valley proper no cultural development is demonstrable corresponding to that portrayed in the Vedic and Purāṇic accounts, until we reach Kuaśmbi. Here the culture of the earliest period is not fully explored nor dated, so we cannot say what stage it represents, and this is true, I think, of the many recently excavated sites in this region. But one fact must be understood. The older we date the Painted Grey Ware or postulate for any Aryan or Vedic culture in this region, the greater becomes the responsibility of the archaeologist. For he hopes, and is expected, to provide material, stratigraphic as well as cultural which will span the long period until the advent of the N.B.P.

Now let us look at the other consequence of regarding Painted Grey Ware as an Early Aryan relic.

First central India, where we have the Navdatoli or the Malwa Ware, its northernmost well stratified site being Eran, and the southern Navdatoli-Maheshwar, the outliers going as far south as Bahal and Daimabad. This and its regional varieties, Nagda and other sites on the Chambal, Prakashe and others on the Tapi-Purna, and even the second phase at Daimabad will have to be considered as pre-Aryans. Or, if we are inclined to accept PARGITER's and RAYCHAUDHURI's suggestions as Earlier Aryan, or better say Yadava in its widest connotation.

However, if the latter suggestion is not acceptable, then we may again think of attributing these cultures to the Nagas and or the Pulindas who are believed, according to some Purāṇas, to be the aboriginal inhabitants of the Narmada valley.

Even the Savaras, CUNNINGHAM thought, were once the inhabitants of the Gwalior region, though now they are mostly confined to the Chota Nagpur Plateau. So these aboriginals might be the authors of these and other Chalcolithic cultures, such as those of the Ajay valley.

Aśmakas who are at times regarded as aboriginals, at times descendants of the Ikśvāku family, and/or some unidentified tribes might have produced the Jorwe-Nevasa culture, though in all these considerations we must provide for mutual exchanges between the north or central India, the Godavari valley or Northern Deccan and Andhra-Karnatak, whoever be the inhabitants of theses regions. Thus while we may according to this line of thinking proceed southwards and regard the authors of the Brahmagiri, Piklihal-Maski-Tekkalakota as the product of aboriginal tribes, like the Boyas, a semi-hunting tribe even today, inhabiting in large numbers the Bellary District and practising some of the neolithic hunting-pastoral customs, still we have to remember that according to the current C-14 dates these are the earliest Neolithic-Chalcolithic cultures. At one time these had spread as far as Bahal on the Girna and perhaps the Narmada on the north, but later received copper and other features from the later arrivals and pushed southwards as far as Brahmagiri.

The best example is Nevasa and probably Daimabad (unfortunately not fully reported) where we have a clear compromise between the northern element and the southern, the latter well exhibited by burials and certain pottery survivals, the former by its fine pottery and blade industry.

If however we are inclined to regard these cultures as early foreign-Iranian or Western Asiatic-penetrations into south and central India, even then we have fairly good evidence. To what I had gathered, ALLCHIN added from his excavations at Piklihal. This has been further augmented by our work this season at Tekkalakota, near Bellary. This consists of

(i) hand-made, grey or black ware spouted pots, as at Shah Tepe.

(ii) vessels with mat impressions at the base on the outside as at Shah Tepe.

(iii) pedestalled bowls with hollow base, exactly as in Hissar B and Shah Tepe.

(iv) vessels with four pinched lips, giving us a wavy outline in plan as in Hissar B.
(v) bone tools as at Shah Tepe, Hissar, etc.
(vi) practice of burying the dead.

Thus out of the six features, four are found at Shah Tepe, and two at Tepe Hissar. But it must be pointed out that there are many other pottery shapes in these Iranian sites which are absent from Central Indian and Deccan or South Indian sites. Thus a complete or full scale transplantation of any specific Iranian culture (Sialk, Tepe Hissar, Tepe Giyan or Shah Tepe or any to be discovered in the future or unknown to me though excavated because the literature is not available) has not taken place. What we see are a few elements, some from Sialk, some from Giyan, some from Shah Tepe and some from Hissar and hence we do not get (nor should we expect) the same chronological and stratigraphical sequence in our sites as in the Iranian. This only implies migration of peoples and cultures probably from Iran, in several waves or stages. And of these, the earliest so far known, would be the Neolithic groups of Andhra-Mysore, the next and near contemporary would be the people bearing the Malwa Ware, to be followed by a few centuries later by the Jorwe-Nevasa people.

Shall we identify further these people or groups linguistically, culturally and ethnically ? For the first and even the second we have no evidence whatever. On the interpretation of a single skull from Piklihal, ALLCHIN proposed to call these people Aryan or Dravidian. This evidence is certainly insufficient. This season we have collected a little more, and it is probable that within a few years we shall get fairly adequate material to know the anatomical characteristics of these people. Even then, it is doubtful, if we shall be able to decide their cultural affiliations in the absence of any more positive data, such as writing, for as pointed out by WASHBURN these questions of race are extremely complicated and not easy of solution by simple anatomical characteristics. Hence it will still give ample scope for the protagonists of the Aryan, Dravidian or/and aboriginal or indigenous theories of cultures.

In Saurashtra as in Central India and the Deccan, we find a number of cultures which followed the disappearance or gradual modification of the Harappan civilization. Can these be explained or interpreted Puranically ? Not quite exactly. According to the Puranic data, the Yādavas colonized parts of Saurashtra after they left Mathura. Now the pottery that we find at Rangpur, Rojadi and Somnath in the later phases is quite different from the Malwa ware. So we cannot interpret these as off-shoots of the Malwa ware. These may be, however, regarded as products of the various tribes who might or might not be related with the Yadavas.

Vedic literature does not mention any Aryan or non-Aryan dynasty or tribe ruling in or inhabiting the Banas valley in southern Rajasthan. PARGITER, however, states on the collation of the Puranic evidence that the large Yādava kingdom appeared to have been divided among Sātvats' four sons and that one of these viz. Devavṛadha, and his son and descendants reigned at Mārtti-kāvata, the first being

connected with R. Parnāsa (Banas). PARGITER calls this region a Sālva country. If there be any truth behind these statements, then the Ahar or Banas culture which is of the same age as the Malwa or the Navdatoli culture, might be *broadly* attributed to the Yādavas.

In this discussion I have left out the question of the Indus or the Harappan Civilization. Certain of its features—particularly in pottery—do show Iranian or Western Asiatic influences. It is therefore not impossible that even this great civilization has been inspired to some extent by the Early Baluchi cultures, which in their turn are the product of Iranian or Western Asiatic influences.

If this view is not acceptable, then we have to supply evidence for its indigenous birth and subsequent development. Here once again we have not got sufficient data. P. L. BHARGAVA (1964) has carried out a very careful collation of the Puranic evidence and the Vedic data and come to the conclusion that if the Purānas are shorn off their exaggerations, then whenever a synchronization is available between the Purānas and the Vedas, they are reliable and help us build up a chronology as well as understand the origin and development of the Aryan expansion in India. His attempt, while it takes back the earliest Aryan arrival into India to c. 3000 B. C. as so many others (PARGITER, PUSALKAR, ALTEKAR) think differs fundamentally from that of others in significant details, which are important from our point of view, though as far as the Bharāta War is concerned, he also dates it to c. 1000 B. C.

BHARGAVA thinks that the Aryans came to India under Manu Vaivasvata and after the great Flood, from somewhere in the north and settled in Saptasindhu in about 3000 B. C. The four or five earliest tribes were the Ikśvākus, the Prāmṣu, Sudyumna, and Śaryāta, who had occupied respectively the west bank of the Indus and the region adjoining it, the last Saryātas lying beyond the Sarasvatī.

When Yayāti was ruling, a branch migrated to Iran under Bhārgava Uśanas, whereas the former's ons Puru, Yadu, Turvasa, Druhyu and Anu spread to the southwest, south-east, west and north from the bank of Sarasvatī.

The Ikśvākus and the Purus (latter called Bhāratas) dominated the political and cultural stage by turns, until the 23rd century B. C. when king Divodāsa of the Tritsus ruling at Kāśī and his son Sudās defeated the confederacy of the ten kings on the Paruṣṇī (Rāvi). After this, Yādavas led by Agastya crossed the Vindhyas and entered south India.

Rāma Dāśarathi, BHARGAVA places in 1600 B. C. He ruled in Kośala and this period marks the farthest extent of Aryan expansion in India.

Kuru, also known as Pariksit (I), ruled at Hastinapura (Āsandivat) in 1300 B. C. and the Bhārata War was fought some 300 years later in about 1000 B. C. Thus ended the Vedic age.

Taking up the last, we might relate, as we do today, the Painted Grey Ware with the Kurus or a branch of the Aryans, but this would be the very last, not even the second Aryan wave or arrival according to WHEELER.

Further we shall have to find out some relics for Rāma in Kośala in about 1600 B. C., Agastya and his band of Aryans from N. India, the Yadavas in Vidarbha, and so many earlier Yadava, Puru, Ikṣvāku and other tribes in the Gangetic Valley and in the Saptasindhu.

Leaving aside the question of probable time periods suggested by BHARGAVA for Aryan occupation and expansion for different regions in the north, including Rajasthan and Saurashtra, have we got evidence enough for associating any of the tribes with any pottery groups?

Just now we have not got sufficient data for minor sub-groups in the Gangetic valley. But in Sind, Baluchistan (also probably Afghanistan), Kutch and Saurashtra, a number of pre—, contemporary and post-Harappan cultures have beer brought to light. So those scholars who are inclined to regard the Harappan as an Aryan culture may welcome BHARGAVA's hypothesis viz. the early Aryan habitation in the Saptasindhu to which I have made a brief reference above.

But having accepted this, one does not find any evidence for subsequent expansion in the central Gangetic valley, the ancient Madhyadesha, unless one regards the rolled (ochre-washed) pottery as the likely claimant for this honour. If this turns out to be as widespread as the Painted Grey Ware and can be dated as well as its associated culture known in more detail, then some further speculation is possible.

So what we want is more data, particularly from traditionally known sites. This can be had if the various universities in U. P. work on a planned basis.

A possible tentative structure could be as follows :

1.	c. 3000 B. C.	Early Aryan habitation in Saptasindhu	Indus or Harappa Civilization.
2.	c. 2500 B. C.	Aryan Expansion in the Gangetic Valley and Gujarat (Saurashtra)	Spread of Indus Civilization in the Gangetic Valley and Saurashtra (Rolled or Ochre-washed pottery)
3.	c. 2000 B. C.	First break up of the five Aryan tribes and dispersal from the Saptasindhu	(a) Central Indian Chalcolithic : Navdatoli, Nagda, Eran, etc. (b) Banas or Ahar culture. (c) Neolithic cultures of the Deccan
4.	c. 1500 B. C.	Further expansion, eastwards and southwards.	(a) Jorwe-Nevasa culture. (b) Sonepur, Raja Dhibi. (c) Rangpur. (d) Somnath.
5.	c. 1000 B. C.	The Bhārata War	Painted Grey Ware.

This might appear as a very facile, simple way of solving a very complex problem. As the equations stand we find difficulty in explaining the existence of Neolithic cultures in the Deccan in 2000 B. C. except as a very early Aryan penetration in the south. Of course, this way of thinking also takes for granted that all the earlier pre-existing hunting-fishing (Mesolithic) cultures are to be attributed to aboriginal tribes, by whatever names we may choose to call them and that all the basic or fundamental civilizing features such as agriculture, pottery, houses, advanced stone-tool technology were introduced by Aryans or a people or peoples from Iran. And lastly the Indus or Harappa Civilization itself is Aryan or foreign inspired. This is a point of view which few scholars are willing to accept.

In summary, then we may say that :

(A) with the definite dates provided by C-14 determinations, in a large part of the Indo-Pakistan continent, barring perhaps the extreme south and Assam and the area covered by the Indus or Harappa Civilization, there existed cultures and peoples or communities who technologically were in a stone Age, though possessing tools and weapons of copper or bronze as well, that economically these depended largely on primitive agriculture-cum-pastoralism and not much on hunting-fishing.

and

(B) Combining this evidence with that from Vedic literature and the Purānas, it might be postulated that,

(i) there was an Early Aryan Culture in the Gangetic Valley ;

(ii) there was a pre-Aryan or earlier Aryan culture in Central India and the Deccan (or Maharashtra, Andhra-Mysore).

(iii) the people or culture in (ii) might be due to Iranian or Western Asiatic influence and contacts or actual migrations and might be found to be Aryan or Dravidian.

(iv) If the hypothesis (i-iii) are not aceptable, these cultures will have to be regarded as aboriginal and probably attributed to tribes such as the Pulindas, Savaras, Nāgas, etc. Levi has already pointed out that the names like Kośala—Tośala, Aṅga Vaṅga, Kaliṅga-Vanga are Austro-Asiatic in origin and imply such a population in the dim past.Linguisticians and anthropologists have already postulated that the earliest people in India are Negrito, who arrived in India from Africa, through Arabia. Next were the proto-Australoids or the Austric people from Eastern Mediterrnean and now represented by the Sabaras, Pulindas, Bhils and Kolas. The third group is the Dravidian from the Meditearrnean area through Iran, and lastly the Aryans.

(v) Vertical excavations at sites in the Ganga-Yamuna doab (such as Kampila, capital of the Paṇchālas and Kānya-kubja (Kanauj) Suktimati, capital of the Cedis, Kāśi, Daṇtapura in Kaliṅga and Janakapura on the Nepal border which are mentioned in Vedic, Puranic and other literature and satisfactorily indentified) be undertaken with a view to ascertaining the sequence of cultures.

Appendix :

Recently A. D. Pusalkar (1964), has briefly restated the Vedic and Purāṇic evidence. In the Ṛgvedic period the Bhāratas had settled between the Sarasvatī and the Yamuna, the Trtsus east of Parusni (Ravi), Purus on either side of the Sarasvatī, Sūnjayas in the neighbourhood of Pañchāla, Druhyus, Turvasas and Anus between the Asikani and Parsṣṇi, Yadus in southern Punjab, Matsyas probably around Jaipur, Cedis between the Yamuna and the Vindhyas, and Usinaras and Vasas, the "middle country." That the Punjab, parts of Sind and north Rajasthan and Western U. P. were inhabited by the Ṛgvedic tribes. Where exactly the Dasas, the enemies of the Aryans lived is difficult to say. These might have occupied the above-mentioned regions as well as the regions further eastward and southward.

During the later Vedic age, the old rivals Purus and the Bhāratas joined the Kurus and with the Pāñchalas, Vasas and others dominated the Madhyadeśha. Eastwards of these combinations had arisen Kośala, Kāśi, Videha, Magadha, Aṅga and Vaṅga. In the south new tribes such as the Sātvants, Vidarbhas, Niśadhas, Kuntis had now appeared, along with the Āndhras, Puṇḍras, Sabaras and Puliñdas on the border of the Aryan settlement.

The puranic evidence as gathered and interpreted by Pargiter, Altekar and Pusalkar shows the birth of the Aryan settlement in the Ganga-Yamuna doab, around modern Allahabad and expansion in three stages, corresponding to three yugas, viz. Krta, Tretā, and Dvāpara. By the end of the first, the Aryans spread over the whole of north India from Sind in the west to Bengal in the east. They had conquered or colonized the Narmada valley, Saurashtra and Vidarbha and then proceeded further south in Aśmaka and Mūlaka. Later they marched further eastwards and southwards, reaching the far south in the time of Rāma.

It must be said that the interpretation of the Vedic evidence is not much different from that given by Bhargava (discussed above), but the Purāṇic evidence cannot be harmonized with the present archaeological data and even the historical as known from coins and Greek sources. There is very little evidence of the Śakas, Yavanas and others having gone out of India in Purāṇic and historic times to countries in north-western India. The entire history of foreign immigration to India is against such a theory.

COMMENTS

U. V. Singh :

Dr. Sankalia has covered most of the ground in respect of excavations and C-14 dates, however, I feel a few points could still be made.

For this sub-continent, on the one hand, we have literary evidence, and on the other, material evidence supplied by the excavations. On the basis of both the types of evidence, an almost continuous sequence of culture has been known, but the most difficult problem is to correlate these two evidences satisfactorily and this we have not been able to do uptil now. Moreover, the authorship of most of

the cultures excavated remains disputed. For example, it is thought by some scholars that the Harappan culture may not be pre-Aryan but Aryan. Similarly the association of Painted Grey ware with the Mahābhārāta Period does not tally with the material equipment of the people mentioned in the Epic. Of course, we shall have to give sufficient allowance to the exaggeration and interpolations in the literature due to their compilation in the later ages, but still the literary evidence cannot be rejected outright.

I think all will agree with SANKALIA in rejecting the long chronology framed by the historians on the basis of the evidence of Epics, Purāṇas etc. In the light of the early cultural remains in India, we are in a position to consider only the short chronology of the historians.

Here I would like to make a mention of the recent theory of TRIVEDI according to whom the date of the Bhārata war 3139 B. C. and that of Buddha's Nirvāṇa 1793 B. C., Bhasa flourished in 1744 B. C., Chandragupta Maurya and Chanakya in 1535 B. C., Kanishka in 1356 B. C. He assigns Indus Valley Civilization to 1951 B. C. I am sure, no archaeologist and not many of the historians will agree with his view. Probably this was the reason why SANKALIA did not make a mention of this in his paper.

We shall not be able to correlate the two types of evidences—literary and archeological—unless we satisfactorily date the Vedas and the two Great Epics. As the evidence stands today, the Painted Grey Ware is associated with the Mahabharata Period, except for the fact that the rich equipment of the people mentioned in literature (the Epic) is almost absent in the Painted Grey ware levels. This Painted Grey Ware may represent the late Aryans and not the early Aryans. The date of P. G. W. (1020—120 B. C.) arrived at by the C-14 dating of Atranjikhera, according to the excavator, may go still earlier. This site has assumed great importance due to the presence of an independent Phase of Black-and-Red ware in between ochre coloured ware and Painted Grey ware phases. This discovery will certainly carry back the date of the early cultures in that region. Of course, the excavator is present here and he will be able to throw more light on this subject.

In Central India, if the Chalcolithic cultures are taken to represent the earlier Aryans, then the first problem will arise about the route they followed in India and how to explain the absence of the remains of this culture in the intervening land through which they might have reached Central India.

In the Chalcolithic phase at Eran, in association with the black-on-red and painted black-and-red wares, Grey ware in large quantities has also been recovered. This ware is wheel turned and is sometimes painted in red with simple linear designs (such as horizontal bands, slants and wavy lines in between horizontal bands and row of filled diamonds). Thinner shreds of this ware are usually of finer fabric. This grey ware does not seem to have any similarity in fabric, type and painted motifs with the well known painted grey ware of the Gangetic valley. On the other hand, it seems to form an integral part of Chalcolithic culture at the site, as it contains typed and painted motifs not different from those of the contemporary red ware. Nor the ware has any similarity with the Neolithic burnished grey ware of South India, although the Neolithic association at Eran, is

attested to, at least in the latest phase of Chalcolithic culture, by a single piece of a Neolith. Previously one complete neolith was collected from the surface at Eran. From Bhind dist ict also, in the collection of theCentral Circle of the Archeological Survey of India, there are a few fragmentary sherds of grey ware which seem to have some similarity in fabric at least, with the Chalcolithic Grey ware at Eran. As the Bhind region has also yielded many Painted Grey ware sites, it will be worth while to explore some promising site which may yield both the above types of grey wares or at least on the basis of which some sort of link may be established between these two regions.

As regards the Chronology of cultures (on the basis of archeological evidence) in Central India, the lower limit of chalcolithic period has been satisfactorily dated by C-14 test, but the upper limit of it is yet to be determined convincingly. One of the samples from a late phase of the Chalcolithic Period at Eran has been dated by C-14 test to the 7th century B. C. If that is so, we have almost a continuity of culture in this region, as the beginnings of the early historic black-and-red ware in that region can be ascribed to c. 7th century B. C. To ascertain this and to check up the C--14 dates supplied by the University of Pennsylvania (the dates of two samples have some discrepancy) few more samples from almost all the levels of the Chalcolithic as well as early historical period are being sent to the Tata Institute of Fundamental Research.

To sum up, I put the following points for the consideration of the house.

1. While examining the traditional chronology and C-14 dates of the excavated sites, it should be first decided whether the Harappan culture is pre-Aryan or Aryan ? How to fit in the new elements at Lothal (viz. knowledge of horse, rice, and the fire-cult in the Harappan culture) would be the next problem. Of course a satisfactory decipherment of the Indus script will certainly lead us to establish its relationship, if any, with the later cultures in different parts of India, and the earlier cultures outside.

2. As mentioned by SANKALIA, the conclusions of ALTEKAR and others are worth testing by excavations of the sites mentioned in Vedic and Puraṇic literature and satisfactorily identifying them.

3. It should also be ascertained whether the Ṛigveda represents the first wave of the Aryans in India, or do we get any remains of the Pre-Ṛigvedic Aryans in India ?

R. C. GAUR

On the basis of the C-14 dates now available for a number of excavated sites and BHARGAVA's chronological theory, SANKALIA seems inclined, though hesitatingly, to regard all the proto-historic phases from the Harappan down to the P. G. WARE, as belonging to the Aryan civilization. To justify his hypothesis he has subdivided this long span, approximately from 3000 B. C. to 1000 B. C., nto the following sub-phases :—

1.	C. 3000 B. C.	Early Aryan habitation in Saptasindhu	Indus or Harappan Civilization.
2.	C. 2500 B. C.	Aryan Expansion in the Gangetic Valley and Gujarat (Saurashtra)	Spread of Indus Civilization in the Gangetic Valley and Saurashtra.
3.	C. 2000 B. C.	First break-up of the five Aryan tribes and dispersal from the Saptasindhu	(a) Central Indian Chalcolithic. (b) Banas or Ahar Culture. (c) Neolithic culture of the Deccan.
4.	C. 1500 B. C.	Further Expansion, eastward and southwards.	(a) Jorwe-Nevasa Cultures. (b) Sonerur, Rajar, Dhibi. (c) Rangpur. (d) Somnath.
5.	C. 1000 B. C.	The Bharata war	Painted Grey Ware.

BHARGAVA's analysis of Aryan expansion is based on his own interpretation of Puranic and Vedic texts, whereas the C-14 dates fix the survival span of different cultural sequences revealed during the course of excavation in the different parts of India. While trying to work out the correlation between the two types of data, SANKALIA seems to have paid insufficient attention to the literary evidence of the Vedas whose importance in evaluating archeological data belonging to the early Aryan period can hardly be overemphasised. In the excavation of the proto-historic sites, the cultural material exposed so far does not reveal a process of gradual development or expansion of the same people, nor that of the evolution of a particular culture. The spirit of the Vedic culture seems to be wholly missing in the Harappan relics as well as of those represented by the industries of O.C.P., and Black-and-red ware. No definite link has so far been established between Harappans and O. C. P. people. Similarly these two cultures seem to be obviously different from that of the Black-and-red ware using Chalcolithic people. It is needless to say that the cultural remains of the P. G. ware phase are so different from the preceding culturas that there seems to be hardly any affinity between them.

SANKALIA's view, however, has been supported to some extent by S. R. RAO, the excavator of Lothal. He also appears to notice some Aryan elements in the Harappan culture. To quote him, "It is now firmly established that the horse was known to the Harappans both in their mature as well as degenerated phase. Rice was also known to them. They worshipped the fire. Hence at least one of the elements in the Harappan-culture may be related to the socalled Aryan cultural group".

It is not easy to accept this agrument. Firstly, the identification of the remains of the horse and the fire-worship place is still not free from doubt. Secondly, even these relics have not been found at the other Harappan sites so far.

On the basis of the evidence so far available, the hypothesis of B. B. LAL put forward on the basis of the Hastinapur excavations does not appear to have been convincingly rejected. His view seems to be further strengthened by the excavations at Atranjikhera. Though, even this observation is based on the digging of an inadequate area, the balance of probability seems to be on the side of Aryan association with this P. G. Ware phase culture. The P. G. Ware industry associated with the fully developed iron industry, is the first archeological sign of the Aryan advent in India. If this view be accepted, there would be no necessity for including a number of pre-,contemporary and post Harappan cultures within the sphere of Aryan civilization, since they look quite different from each other.

The recent C-14 dating of the charcoal sample from a mid phase of P. G. Ware industry from Atranjikhera has provided a good time span to explain the history of Aryan expansion in India. Fortunately the Balck-and-red phase of Atranjikhera, lying just below the P. G. Ware phase, has yielded this year charcoal and charred bones which have been sent to the Tata Institute, Bombay, for C-14 dating. The results of these samples would determine the earliest limit of P. G. Ware industry in the Ganga valley. If the Aryans in the early Rigvedic phase were confined to the Saptasindhu region, it would not have taken them a very long time to move from there to the Ganga Valley. By the last phase of Rigveda the Aryans seem to have become familiar with the Ganga-Yamuna Doab. On the basis of the foregoing arguments the history of the Aryan expansion may thus broadly be divided into three sub-phases :—

1. Pre 1000 B. C. .... Rigvedic Culture.
2. 1000 B. C.—800 B. C. .... Later Vedic Period including '*Bhārata*' war
3. 800 B. C.—600/500 B. C.......... Decline of the Vedic period (Pre N. B. P period)

If the Bharata war took place somewhere during the mid phase of the P. G. Ware industry, a date also suggested by RAYCHAUDHURI (9th cent. B. C. being the the date of a ccession of Parīkṣita), our chronological problem about the Aryans may be solved to some extent. Of course, even this hypothesis is quite tentative and needs careful confirmation by area digging on a large scale of the P. G. Ware sites and C-14 dates.

However the study of the Aryan expansion must be studied in the light of the fully developed iron industry and swift moving horses, without which this militant race would not have established its supremacy over the Asuras, Dasus etc. of the Rigveda. An echo of this is hidden even in the early hymns of the Vedas. So far as on present knowledge goes, we do not know of any cultural phase other than that of P. G. Ware which is associated with fully developed iron industry and expensive use of horses from its very beginning. Finally the image of culture which emerges from the study of the Rigevda seems to correspond more to the P. G. Ware phase than to the Harappan phase of Proto-Indian History.

Y. D. Sharma :

The author of the above paper warns that it is " an eassy in speculation ", but there is perhaps far more speculation than is good for an archaeologist. I also feel that it is too early to bring in C-14 dates for comparison with traditional Indian dates. We should go by stages. We may first examine to what extent the literary picture of a people who are supposed to have inhabited a particular area agrees with the archaeological picture of the region and whether there exists a fairly strong case for identifying the two cultures, one derived from literature and the other from excavation. If there exists no case for indentification, further speculation should cease. If, however, there is a case, the archaeological and C-14 dates can be compared and weighed. Direct comparison of traditional and C-14 dates would lead us nowhere when the identity of the cultures dated by these two methods is not established.

C-14 may certainly give us the date of a particular culture in a region, but it does not facilitate identification of that culture.

Nasik may have been known to Panini as Nasik, but one could not be sure that it was also known by the same name in chalcolithic times.

Vedic Aryans and the Mahabharata War :

Of the two dates suggested by RAYCHAUDHURI for the Mahabharata war, 1400 B. C. and 900 B. C., only the latter may possibly tally with the archaeological data in the sense that in north India the Painted Grey ware culture is believed to be Aryan. In fact, as I have argued in one of my papers (1964.) the Painted Grey ware people appear to be fairly close to the Vedic Aryans, judging from the literary and archaeological data. In 1400 B. C., only the Harappans could have been living anywhere near the site of the war. Of course, one may argue that the Harappans are not different from the Vedic Aryans. But that is an old controversy, and most archaeologists, I believe, would take Harappans as not merely different from Vedic Aryans, but also earlier than the latter. If the date of 1400 B. C. also implies that by about 1200 B. C. eastern India had organized itself into a distinct cultural unit, it is not substantiated so far by the archaeological evidence. Nor is C-14 date of such an antiquity available from that region at present.

The same difficulty of having to identify the Harappa or even pre-Harappa cultures with the Vedic culture is met with if we were to accept ALTEKAR's chronology. His early Vedic period, from 2700 B. C. to 1500 B. C. would be covered by pre-Harappa and Harappa cultures; the Middle Vedic period, from 1600 B. C. to 1000 B. C. by the Harappa and Painted Grey ware cultures; and the Late Vedic period, from 1200 B. C. to 600 B. C. by the Painted Grey Ware and possibly early Northern Black Polished Ware cultures.

I do not think that Pandu-Rajar-Dhibi presents any difficulty if the Painted Grey ware culture is to be associated with the early Aryans. The Pandu-Rajar-Dhibi culture may have existed in Bengal before the arrival of the Aryans. It has common points with both central Ganga and Deccan cultures, such as black-and-red ware, including some shapes and iron from the former, and burials, microliths and neoliths from the latter. Exploration in Orissa might throw light on

whether a penetration of certain elements from the Deccan took place through that region. The difficulty is that we are not sure of the periodization and stratigraphy of Pandu-Rajar-Dhibi. The single C-14 date also has been furnished by a laboratory, which has not given any tested dates for other sites.

I may add that Pandu-Rajar-Dhibi black-on-red ware is quite different from the Malwa ware, so also is its open spout, a jip rather than a long channel spout with which we are familiar in the Malwa ware.

Naramda Valley :

The pottery from Navdatoli may have certain analogues with pottery in Iran. But perhaps the differences also are not inconsiderable. In fact, while the Iranian culture is in the iron age, the Indian is chalcolithic. At best, there may have been come contact between the two regions through Baluchistan. RAYCHAUDHURI's suggestion that the Yādavas of the Naramda valley were an early Aryan tribe which came from Persia may have some significance. But if so, these people must be non-and pre-Vedic, and perhaps quite different from the Yadavas of Mathura. The C-14 dates of Navdatoli may not conflict with this. All the same, in the absence of any definite evidence of the migration of the Iranians to the Narmada valley, one cannot take the suggestion seriously.

The Deccan and South India :

There may be Some correspondence between the Iranian pottery and that of the Deccan or south India in Neolithic-chalcolithic times. But it does not take us any further, not to a migration from Iran in any case. I feel we must first make an analysis, quantitative and qualitative, of both common and differing elements in the two cultures, and then only we shall be in a position to say if we can take this presumed contact seriously. At present, it appears, we are carried away by similarities and we ignore the dissimilarities.

One may certainly undertake excavations at selected sites mentioned in literature, but not in the hope of ascertaining their ancient names, as their identity may not be settled by excavation. The controversy about the identification of ancient Mahismati and Dwarka still continues after the excavation of Maheshwar and the present Dwarka.

NOTE

(1) Though it must be said to the credit of TILAK that his view (*The Arctic Home in the Vedas*, 1956, p. 36) that the Arctic region was warm and hence habitable around 10000 B. C. during an interglacial period has been proved to be correct by geologists and others who analyzed deep seacores from the floor of the Atlantic and Arctic oceans. Owing to this reason, it is believed that Early Man could cross Siberia and Alaska and go down to North America. *Science Digest*, May, 1958, p. 11.

(2) This is unfortunately a misnomer. First hand study of such pottery from a site near Chandigrah collected by Sri Suraj Bhan showed that there is no wash, but the effect is due to water logging and rolling. It is really a red ware, having red slip.

(3) Here recently Dr. S. B. Deo has succeeded in finding Painted Grey Ware while conducting explorations on behalf of the Indian Aid Mission in Nepal.

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SOILS AS ENVIRONMENTAL AND CHRONOLOGICAL TOOLS

B. B. Lal

The weathering of rocks brought about by physical and chemical action produces soils. In other words, soil is the product of the decomposition of the land-surface due to the action of weather and vegetation. Soils, therefore, serve as climatic calenders and are studied for constructing climatic chronologies of the ancient past. The study of soils helps in revealing climatic conditions or environments in which the formations took place. Similarly, a study of the activity of ice, glacial deposits and the formation of river terraces helps in visualising the climatic conditions under which they were formed. Climatic chronologies are thus evolved and have been used for developing relative chronologies of the Pleistocene.

How soils and gravels help in reconstructing ancient environment and in establishing climatic calenders will be understood when the mechanism of weathering and disintegration of rock is considered, and the different factors responsible for the formation of soils are studied. Sections of cliffs in the river valleys have often been found to possess buried surfaces composed of soils. These ' buried ' or ' fossil ' soils not only mark the horizons representing ancient land-surfaces, but also lend themselves to the reconstruction of climatic conditions under which they were formed, thus providing significant data about the environmental conditions of the times.

The weathering of rocks is a complicated change in which physical, chemical, and biological factors participate singly or collectively. Topography, climate, i. e. temperature, rainfall and wind activity, nature of sub-stratum and vegetation are some of the more important soil-forming factors and careful analysis of soils and gravels is important for the study of these factors. The soils or sediments laid down by nature or deposited by man may contain organic remains which lend themselves to the investigation of local environment and flora and fauna of the time. For example, remains of wood, seeds, animal and human bones, and shales etc. which are found in soils and sediments are studied for eliciting information about the climate, vegetation, and the fauna of the time. Similarly, the study of soils occasionally gives an idea of the density of population of a site so that it is possible to visualise the general environmental conditions at the site. Both lifeless and living environment are of interest to the archaeologist and the study of surface geology, climate, flora and fauna which is mainly based on the study of soils, gravels and sediments yields necessary information for reconstructing the environment.

When a land-surface is exposed to atmosphere, complicated changes take place leading to the formation of a great variety of residual products the ultimate nature of which is determined by the climatic conditions, river and sea action, and the effect of ice and wind.

ROCK EXPOSED TO ATMOSPHERE

(a)	(b)	(c)	(d)	(e)	(f)
Physical weathering	Chemical weathering	Action of flowing water	Action of Sea	Action of Ice	Action of wind.
Insolation and frost action cause disintegration of rock	In the presence of moisture and humus, rock *disintegrates and partly dissolves.*	Streams and rivers scour valleys.	Sea destroyes cliffs	Ice scour valleys	Wind grinds and polishes rapidly.
Rock waste accumulates on slopes; which cemented it becomes breccia (angular fragments cemented together); when loose, talus.	Soils are formed: 1 Podsol. 2 Brown. 3 Black earth	Rock waste, which is quickly rounded off due to rolling.	Boulders	Transported material, unsorted (unlike water) deposited under and in front of glaciers as boulders, clay or till	Faceted by blown sand-drei-kanter
Dissolved material 'salt' reaches sea or inland lake.	4 Laterite 5 Hard pans	Large pieces become boulders. Further erosion produces	Shingles (Beach pebbles)	Tillite (when hardened)	Wind removes small particles only, but rounds them off rapidly.
Dry climate.	6 Rendzina.	Pebbles	Conglomerate	Melt water starts sorting	Eolian sand (dune sand) frosted surface, and rounded.
Evaporation leads to concentration and precipitation in this order :	Dissolved material 'salts' reaches sea or inland lake. Ordinary or damp climate.	When cemented, they constitute a gravel sheet.	Beach sand	Glaciofluvial gravels	Fine dust transported by air currents and laid down as eolian silt
		Conglomerate (cemented)	When consolidated it becomes marine sand-stone.		Loess
		Sand	Mud, clay		
			When hardened mudstone, shale.		

Calcium carbonate (limestone)
Anhydrite and gypsum rock salt (sodium chloride)
Potassium & magnesium salts (highly soluble and hygroscopic)

Salt remain in solution, unless organisms cause precipitation
Limestone, chert and flint
limonite
phosphates

Hardened and cemented sand becomes sandstone and quartzite (Metamorphism)

Silt (when hardened, it becomes silt-stone)

Clay (when hardened becomes)

Mudstone or shale.

Clay often banded varved Clay

In dry climate, insolation and frost action bring about physical disintegration of exposed rocks. Rock waste thus accumulates on hill slopes. Evaporation leads to the concentration of soluble salts and their eventual precipitation in ascending order of their solubilities. The rock debris or talus does not offer effective cover to the exposed rocks and insolation and frost action thus dominate the weathering of rocks in cold and dry regions or hot deserts.

In damp climate, chemical action dominates the weathering; and in presence of moisture and humus, disintegration of rocks and leaching of soluble materials proceed apace with the formation of soils. Salts remain in solution unless organisms cause precipitation; they are partly transportd to long distances by flowing water and partly precipitated with the formation of limestone, chert, flint, hydrated oxides of iron and phosphates.

The action of streams and rivers causes the formation of valleys, and rock waste or rock debris is quickly rounded off by abrasion with the formation of large boulders, pebbles, and gravels. Further weathering results in the formation of sands of various grades; they are further attenuated with the formation of silt and the finest material smaller in size than 0·002 mm. is clay.

Sea waves destroy cliffs with the formation of boulders, shingles, beach sand, silt and clay. Their consolidation produces marinse deposits like conglomerate, breccia, sandstone, mudstone, and shale.

Movement of ice in the form of galciers results in the scouring of rock terrain and formation of valleys. The rock debris is removed without sorting and is deposited under, in front of, and on sides of glaciers. Melt water, however, brings about a sorting of the debris with the formation of glacio-fuvial gravels and clays. The latter are generally laminated and are called varved clays which have been used for dating.

The action of wind is to grind and polish the rock debris; sometimes facetted pebbles are formed by blown sand. Wind transports only small particles, but rounds them off rapidly; eolian sand is thus formed. Such sand is rounded and frosted. Finer grains are carried off by air currents over long distances and are laid down as eolian silt called loess. Loess deposits are, therefore, made of fine silt which is well sorted in the grade 0·02 — 0·07 mm. they do not show any stratification. Loess is thus admirably suited for environmental and chronological studies.

From the above it is clear that rocks exposed to atmosphere undergo extensive and intensive disintegration and weathering. The chart appended herewith indicates the various effects of different factors which are responsible or the formation of soils, scouring of valleys and the development of different land forms.

In cold regions, the vegetation is sparse or absent and water is frozen for many months of the year or is absent. The weathering of rock surface is, therefore, a physical process and chemical action is absent or negligible. Due to solidification and liquefication of water, internal strains are set up in the rocks which disintegrate forming frost soils. The rock disintergration being largely mechanical, incoherent surface deposits are formed without appreciable chemical alteration of constituent minerals. The resulting debris is removed or transported by gravity or wind and this is aided by absence of vegetation, as, in its presence, the transportation of rock debris is hindered and a protective covering of soil may form which may prevent further disintegration of the rock. As a result of removal of rock waste (deflation) there is little chance of a protective covering of soil to develop and the naked rock is fully exposed to atmosphere resulting in its progressive mechanical disintegration. The rock disintegration resulting from thawing and freezing is, however, not so easily arrested by the blanket of debris but continues to be operative at greater depths.

In hot deserts, rocks disintergrate because of extreme changes in daily temperatures. Both mineral and block disintegration account for the weathering of rocks. Mineral disintegration is caused by repeated heating and cooling, but without any sudden change in temperature. This cycle causes fractures to develop between adjoining crystals which finally break down into individual crystals. Granites are particularly liable to mineral disintegration.

Sudden changes of temperature in hot deserts bring about the disintegration of rock into small fragments rather than in separate crystals. Such disintegration may be caused by cold rain falling on isolated rocks. Exposed rocks may also be subjected to sudden changes at sunrise and sunset due to bad conduction. Splitting or mechanical exfoliation thus cause the weathering of the parent rock.

The disintegration due to temperature variations is, however, confined to rock surface and if the rock debris resulting from mechanical weathering is allowed to form a blanket over the rock, further disintegration is prevented. If the disintergrated debris is removed by transportation as promptly as it is formed, the weathering proceeds apace and entire rock masses may suffer total disintegration. The process of rock disintegration is thus brought about by (i) changes in temperature causing repeated expansion and contraction and (ii) alternate freezing and thawing of water, and is aided by the transporting agencies.

Frost soils show curious structures, such as rings or polygons; these were the cracks once filled up with ice. They are therefore called structure soils. In frost soils, a network of coarse fragments encloses central portions composed of fine earth. Such soils are found in areas which were actually not glaciated, but which witnessed periglacial climate and experienced a cold climate in the glacial phases.

It has already been observed that under conditions of extreme cold or extreme aridity weathering takes the form mainly of mechanical disintegration and

chemical change is less conspicuous. Under ordinary conditions of temperature and humidity, however, processes of chemical decomposition are very apparent. The rock exposed to atmosphere becomes softened, loose and incoherent. Voids and openings make their appearence in the rock. The volumes tends to increase, if all the end products are taken into account. The original minerals, largely felspar and ferromagnesium minerals are changed to clay, mixed with quartz and sand, calcite or dolomite and iron oxide together with residual particles of the original felspars and ferromagnesium minerals which may have escaped total alteration. Water, oxygen, and carbon dioxide, all common constituents of the atmosphere and hydrosphere, have been added and certain constiutents of the rock such as soda, potash, lime, and magnesia have been carried away by flowing waters to be redeposited elsewhere as sediments, vein fillings, and cements.

Water containing dissolved oxygen and carbon dioxide is the principal inorganic agent in rock decomposition but once the weathering has started, other compounds, some of which are much more destructive, also begin to play their part. Soda and potash are released by hydrolysis of felspars and go into solution as carbonates; the resulting alkaline solutions are capable of dissolving silica and of decomposing many silicates at ordinary temperatures and pressures.

Among organic agencies, the chemical work of plants is of greater importance in the weathering of rocks. The organic matter of plants, on their death, is broken down into numerous organic compounds. In the early stages of decay of vegetation, humic acids are formed; as decay progresses, the nitrogenous and other organic products are slowly oxidised to carbonic acid and nitrates, mainly through bacterial activity.

The decay of vegetable matter in the presence of moisture, carbon dioxide and oxygen results in a great concentration of carbon dioxide in the belt of weathering and also leads to the formation of other organic acids, which are likely to be carried down and brought in contact with comparatively unweathered rock. For these reasons the course of chemical weathering is deeply influenced by the presence of solutions derived from the decaying organic matter in the overlying strata. The formation of soil by chemical weathering of rocks is thus a function of a large number of independent factors, the most important of which are (1) parent material or substratum, (2) climate, (3) vegetation and (4) topography.

The soils and soil profiles with different weathering horizons and weathered and fresh sub-stratum or bed rock at the base are characteristic of certain climatic regions. The effect of parent material is often very conspicuous. On parent material which is acidic or poor in bases, profiles of " wetter type " generally develop, whereas on parent material which is rich in bases, the " drier type " of profile is likely to develop. Humic acids produced by the decay of organic matter derived from plants and animals are colloidal in character and they may move to lower levels causing complicated chemical changes in the fresh rock, and their eventual breaking down with the formation of soils.

In its final form, humus is an amorphous, dark brown colloidal substance capable of retaining moisture in dry conditions and shrinking markedly when

dry, and swelling considerably when wetted again, so that its repeated shrinkage and swelling helps to maintain an open texture in the product of weathering, and to bring carbon dioxide and moisture into contact with lower portions of the rock, which for want of channel would have normally remained inaccessible to the destructive agencies of moisture, air and vegetation.

The chemical processes involved in the weathering of rocks are (I) hydrolysis or action of water or mineral constituents or rocks, (iii) oxidation, or the action of oxygen of the atmosphere on rock components, (iii) carbonation, or the effect of carbon dioxide and (iv) solution of ground water.

The above processes are responsible in varying degrees for the decomposition of rocks in humid, hot and temperate regions. Which of these weathering processes are operative and predominant in a particular case would depend, besides other factors, upon the nature of the rock, but almost all of them contribute to the chemical weathering of rocks under humid–temperate and humid–hot conditions. This is to be expected since most of rock masses are exposed under these conditions to the action of water, carbon dioxide and air.

In cold and arid regions, the above processes of weathering do not come into play; the rock destruction is then largely mechanical or physical and chemical changes are least conspicuous. The rocks are broken down under conditions of extreme cold or extreme aridity with the formation of incoherent gravel and finer deposits without the chemical alteration of the mineral constituents.

In hot and humid regions, the above-mentioned processes of hydrolysis, carbonation, oxidation and solution bring about intensive weathering of rocks with the formation of residual deposits of diverse kinds.

Under humid temperate conditions, the complex alumino-silicates are decomposed with the formation of hydrated silicate of aluminium as a residual deposit constituting the clay fraction.

In hot and humid climate of tropical or equatorial regions, the weathering of aluminosilicates goes much further with the complete elimination of combined silica of silicates and felspars. The residual product is a mixture of hydrated oxides or iron, aluminium and manganese. Silica present as quartz is largely left behind. The process is known as laterization or lateritization. The residual deposit so found is called laterite.

Apart from free silica present in the form of quartz other resistant minerals, which are inappreciably affected and are released more or less unaltered by the weathering of igneous rocks, are such accessary minerals as zircon, tourmaline, cassiterite and muscovite. Intensive weathering may in some cases cause corrosion of these minerals. The ferromagnesium minerals are liable to break down under these conditions with the formation of many soluble and colloidal products. Hornblende and biotite are with the formation of clay minerals. No matter what the end products of weathering are, hydrolysis is followed by desilication, solution of alkali and the hydration of the product.

It is not necessary to go into detail to discuss the weathering of igneous and sedimentary rocks. The weathering of such rocks leads to formation of weathering horizons.

In regions with good drainage the movement of water is downwards during the rainy season; when, on account of drought, evaporation exceeds rainfall, the movement of water is upwards. In predominantly humid regions, the downward movement of water is much more conspicuous than the upward movement with the result that soluble salts, fine particles and colloidal material tend to move downwards from the zone of weathering. The upper layer is thus impoverished of these materials, and this zone is called eluvial horizon. The soluble salts are completely eliminated by circulating water, but colloidal matter and finer particles flocculate and get deposited in the lower levels. The former horizon is therefore composed of sandy or loamy top soil and the horizon of eiluviation consists of heavy clay soil,with a dark shade.

Under arid conditions with a not very low water table, soil moisture tends to be drawn up to the surface on account of marked evaporation. The process of eluviation is then reversed and accumulations of soluble salts are noticed in the top layers. The iron compounds, calcium carbonate, calcium sulphate and alkali silicates thus move upwards under strong evaporation and produce hard crusty layers of limestone, silica, ferric oxide and gypsum. If the evaporation is not strong enough, some or all of these compounds accumulate in the form of hard crust in the upper levels before reaching the surface. Nodular calcareous concentrations and hard ironpans, are thus formed below the surface. It is easy to visualize alternate up and down movements of these materials in regions with marked spells of precipitation and drought.

The weathering of rocks results in the formation of soil profiles. If a vertical section through a soil from the surface with its vegetation cover down to unaltered bed rock is examined, it is found more or less clearly divided into zones, formed *in situ* from the parent rock by processes of chemical weathering. Due to translocation of products of weathering in the profiles, zones of accumulation or leaching are formed with their characteristic shades. These zones are not formed as a result of changes in deposition as in the strata of a geological section. but are formed by the movement of products of chemical weathering up and down the profile.

Soil profiles are divided broadly into three main horizons. They are :—

A—horizon—Characterised by the presence of humus and the leading mineral constituents.

B—horizon—Horizon of deposition or coagulation of soluble matter.

C—horizon—Fresh unweathered bed rock.

The various types of soils formed under varying environmental factors are detailed hereunder ;

1. Podsol : Cool temperate region with ample rainfall. Acidic Rocks—three broad horizons—

A—Leaching horizon
B—Deposition horizon (humus and sesquioxides)
C—Parent rock.

2. Brown earth : Temperate region with moderate rainfall, evenly distributed, the summers are not dry—deciduous forest soils.
Rock with alkaline matter—boulder clays, loess and limestones.
Horizons not very well defined—A horizon—containing humus—leaching not conspicuous.

3. Black earth or chernozem : Temperate region with moderate rainfall—Unevenly distributed rainfall—wet spring followed by a long dry summer, a wet autumn and a cold winter with ground frost natural vegetation produces plenty of humus. Leaching is enough to cause translocation of calcium carbonate which is partly deposited lower down in the form of concretions, but leaching is not enough to remove bases which neutralize the humus. This results in soils rich in humus and bases. A & B horizons are not clearly demarcated but the boundary between A + B & C is usually sharp.

4. Laterite and red earths : In humid tropical regions, leaching takes place, alkalis are washed out and the reaction is acid. Humus, if present, is liable to disappear rapidly. Hydrated oxides of iron and alumina tend to get concentrated. Silica is more mobile and is removed.

5. Hardpans : Layers cemented with hydrated oxides of iron are frequently associated with soils and are found a few feet (B horizon) below the surface. Similar hardpans are found in the fresh sub-soil (c) due to fluctuation of water table. These water table hardpans been misinterpreted as ancient land surfaces.

6. Rendzina : Soils formed in lime-stone or calcareous sediments, black to grey in colour because of formation of insoluble calcium humate.

From the above, it will be seen that the nature, composition and characteristics of a soil are determined by the environmental conditions prevailing at the time of their formation and also on the nature of the substratum.

In archaeological explorations and excavations, apart from the natural debris produced from archaeological strata and materials as a result of the effect of time and elements, we generally encounter marine, lacustrine, glacial and glaciofluvial deposits. In addition cave earths and rock shelter-deposits and eolian dust and desert sands are very suitable materials for chronological and environmental investigations. Raised beach deposits and deposits of river-terraces are also suitable for the investigation of palaeo-climate. Their study in our country has not progressed much and it is therefore essential that these materials are taken up for a systematic study.

In India, apart from Gangetic alluvium and deltaic alluvium in different parts of the country, the more important soils which are encountered at archaeological sites are (1) laterites, lateritic soils and the red earth, (2) desert deposits, (3) Regur or black cotton soil corresponding to chernozems of Russia, and (4) loessic deposits. More than a decade ago the environmental conditions at various sites in Gujarat were worked out by F. E. ZEUNER and a climatic chronology was constructed on the basis of detailed investigations of soils and gravels. It is necessary that such investigations are extended to other regions. The eolian deposits in Cutch, Rajasthan and Kashmir should be examined with a view to determining what sort of climatic oscillations were experienced at ancient sites in these regions. Similarly an urgent desideratum of environmental and chronological studies is the study of laterites, lateritic soils, and the red earths in different regions, on account of a close association of prehistoric settlements with these sediments. In the same way a study of Regur, black cotton soil, found in different regions is of great significance because several Chalcolithic sites are located in the black cotton soil areas. These are some of the problems which have to be investigated in detail with a view to reconstructing the environmental conditions which prevailed in ancient times at various ancient and prehistoric sites. In this connection a survey of raised beaches would also have to be undertaken. As pointed out earlier, ZEUNER's pioneering efforts have already given us considerable information about the environmental conditions in Gujarat in the Pleistocene. The need of the hour is to persue this line of investigation in various regions for studying the environments and for constructing regional climatic chronologies.

R. V. Joshi :

We have yet to systematize the soil studies for the environmental and chronological investigations. At present the soil analyses are being undertaken on a very restricted scale. Although this gives some idea of the soil stratigraphy of a silt, the generalizations often made from such studies for climatological purposes, I feel, should be discouraged. Since soil formation is a very complex process involving a slow change of the rock under the influence of climate and vegetation, the results obtained by limited sampling do not necessarily represent the characters of the soils of the whole region. To avoid these pitfalls, it is very essential to have basic data of all the soil groups that are generally encountered in our arachaeological studies.

Two of these soil types are the red soils and the black soils. The red soils or rather red deposits range in grade from fine clays to fine gravelly material, which is often termed as a *murum*. In the lateritic areas these red deposits are derived from the erosion of the laterite formation into pisolitic and coarser lateritic gravel and red clays.

The only process which gives rise to these products is a normal weathering and eventual transport by the running water and hence occurrence will not be of much importance in our studies. But when such deposits are noticed at a locality where the processes of laterite formation and its erosion are not in progress they are definitely interesting. For example, at the Adamgarh site on the Narmada

we came across lateritic clays and debris in the trench which yielded palaeoliths. A naturally exposed cliff, little away from the trench, was a representative section showing, in successive order basal rock, laterite capping, laterite gravel, laterite clay and debris. Many of us who have examined the Narmada between Hoshangabad and Narsingpur have not noticed laterited at the base of the Pleistocene stratigraphy as reported by DE TERRA. But closer studies at Adamgarh now show that the lateritic clay at Adamgarh is comparable to pink concretionary clay of DE TERRA's Lower Group, and I am sure our further work in the adjoining Dhamasa area will throw some light on the laterite problem of the Narmada basin.

In the areas far removed from the laterite deposits, the red clays and gravel, may result under dry climatic conditions from the underlying granite, basalt, sandstone or quartzite rocks. In India this is a common feature in semi-arid tracts. So when we have to interpret their occurrence in such dry climatic areas, the characters of the present climatic conditions will have to be very carefully taken into consideration.

The occurrence of black soils is sometimes ascribed to the ancient or prehistoric forest cover (ZEUNER; 1950). The chemical analyses of many black soils, as far as I know, show a very insignificant proportion of organic matter. The argument often made that the black colouration of such soils is due to high organic contents, thereby indicating a heavy forest environment, does not stand the chemical tests. It is no doubt true that during such a long period substantial organic matter might have leached out. But then the black soils also should undergo colour change. It is also true that the organic matter being in a colloidal state even its little amount is enough to give dark colour effects. My observations are that many of these black soils owe their colour to fine iron and manganese accessory minerals. The black soils also develop well on plain landforms.

In our soil studies we have achieved quite promising results in interpreting dry climatic conditions of the microlithic (Mesolithic) period.

Our microlithic sites are broadly associated with the sand-dunes as in Langhnaj area, coastal sand-dunes as in *teri*-area, Birbhanpur with sandy depcsits, etc. But the rock-shelter sites which are the most well-preserved localities have provided another evidence of dry climate. Here at Adamgarh all the black soil that occurs in the microlithic levels is a wind transported material formed under marked dry climate.

The chemical studies of tool-bearing cemented gravel and sand beds have, however, not shown progress, and I think this needs serious consideration.

Some of our laboratories set up by archaeological institutes will have to devote maximum attention to the fundamental studies of soils instead of serving merely as testing laboraterier. Through experimentation we will have to work out the soil groups of our country which has monsoon climate and a varied geological and physical set up. In our country it is a kind of drawback that we do not have soil and landuse maps as are so well prepared in Great Britain. But this difficulty can be, at least partly, overcome by paying sufficient attention to the basic research on soils and allied materials.

COMMENTS

G. G. Mujumdar and S. N. Rajguru :

In his paper, Lal has introduced the subject by stating the general principles of weathering involved in soil formation under various climatic conditions.

We shall try in this note to discuss some of the methods of soil investigation as they are practised in the field and laboratory, particularly to bring out their scope of application, accuracy, reproducibility and their limitations on the basis of our own experience.

The type of information that one gathers regarding soils and allied deposits depends much on the mode of sampling. Close sampling is necessary when one wants to detect the fossil soil horizon which is many times not visibly distinguishable from the rest of the section. The same is true for collecting the sample for palynological studies. For merely differentiating the various strata sampling at larger intervals, many times one sample from each stratum, is quite enough.

It is essential to avoid the contamination of samples and for this, as far as possible, they should be collected from freshly excavated (and not merely scraped) sections. This way the contamination due to colluvial and redeposited materials can be avoided.

Out of the three methods which are available for the study of particle size distribution, the beaker method, although simple is tedious and time-consuming. Cornwall has recommended the hydrometer method on the basis of its cheapness, rapidity and sufficient accuracy. We have tried in our laboratory the hydrometer method and compared it with the pipette method. It is our experience that personal error is likely to occur while noting the initial readings of hydrometer at very close time intervals, and ultimately this has an important bearing on the nature of curves on which we generally base our conclusions. Besides, the hydrometer method involves tedious mathematical calculations. The pipette method on the other hand has been found to yield direct weights upto at least three fractions viz. coarse sand, silt and clay, and fine sand indirectly, thus enabling us to plot the curves directly without much mathematical calculation. Though this method consumes somewhat more time than the hydrometer method, we have found it to be more accurate.

All the methods of mechanical analysis are preceded by a thorough dispersion of soil material in the aqueous phase. Cornwall has recommended the use of 'Calgaon' (Sodium hexameta-phosphate) for eliminating the influence of calcium carbonate in calcareous soils. We have, however, found that while treating the highly calcareous Indian soils of semi-arid and arid regions, the treatment with 'Calgaon' is not enough. The alternative method, practised in agricultural laboratories, of pre-treatment with dilute hydrocloric acid sufficient only to remove the calcium carbonate, helps in getting a good dispersion. Similarly, the organic matter or humus, one of whose function is to bind the grains and form aggregates of soil material and thereby impart it a good crumb structure, is usually removed completely by treatment with hydrogen peroxide. We have also

found this method quite suitable for our samples and it is our experience that we get quicker dispersion into clearer fractions.

For accurate and uniform description of soil colours the use of *Munsell soil colour charts*, has been found to be very useful. Petrological and chemical investigations of soil colouring matter are likely to throw light on environments. Thus black soils, red (non-lateritic) soils, lateritic soils, red and yellow silts (both kankary and non-kankary) and recent black brown silts from various Pleistocene and Holocene deposits from Peninsular India afford ample scope for further research.

For correct interpretation of environmental conditions, for knowing the geological source areas from where the sediments have been derived, and sometimes for dating the deposits, the application of minerology and petrology is necessary in addition to that of geomorphology. Formerly the presence or absence of felspars in the soils was attributed to the weathering due to climate. But the recent researches (PETTIJOHN, 1957; 127), have shown that the detrital felspar is an index of both climatic rigour and tectonic activity. High relief resulting from tectonic activity appears to be more important than the climate in producing highly felspar-bearing deposits in the hilly, high rain-fall areas. The cementing matrix of calcareous coarse pebbly gravel from upstream areas of river Mutha (Poona Dist.) receiving a rainfall of more than 150 cm. per annum have shown the presence of felspar, thus supporting the above statement to some extent at least.

Preparation of thin section of soil and its study under petrological microscope is in essence very similar to that of rocks. The works of KUBIENA are the main published guide. These micromorphological studies not only reveal the structural make-up in general i. e. the space contents and degree of aggregate formation, but render possible an exact determination of the forms of space and aggregates. Genesis of structural forms and their behaviour with regard to mechanical resistance and water stability are revealed by these investigations, which are supplimented by special quantitative analyses of the structures which not only help us to obtain an insight into natural fabric of the soil but also to ascertain the degree of homogeneity or heterogeneity of the structural formation of various soils. In tropical countries like ours, this invaluable tool of micromorphology will be of immense use for the detailed study of various soils.

A number of methods are available for the determination of calcium carbonate. CORNWALL suggests that equal pinches of several samples in fairly quick succession will give a rough but fair idea of the relative amounts of carbonate present. Besides, he has also recommended the use of Schrotter's flask for quantitative determination of carbonate. It is our experience that the pinch method is not very helpful in getting the idea of the relative amounts of carbonate present in highly calcareous soils. For quantitative work, we prefer the use of Collins Calcimeter which enables us to measure the volume of carbon dioxide evolved from a known weight of the material. Thus in the study of Nevasa fossil soils, the quantitative estimation of carbonate has enabled us to know the depth of carbonate horizon, thereby helping us to draw important conclusions.

The organic matter commonly known as humus is continuously forming and also undergoing decay in the soil. Thus the humus complex results from the degradation of the remnants of vegetation growing on the soil. This process is generally known as humification. A large number of methods are available for the quantitative estimation of organic matter. These include the dry combustion method, the colorimetric estimation of alkaline extract of organic matter, and the wet oxidation methods notably that of Walkley and Black dichromate method. CORNWALL has recommended the use of colorimetric method . We have tried these methods and have noted that the values obtained with colorimetric methods are markedly less than those obtained by using dichromate method. In our opinion, the colorimetric method involves an alkaline extraction of the acqueous suspension of soil material and this is likely to extract only the acidic and the phenolic fractions of the total humus complex; while in dichromate method the whole of the organic complex is affected and estimated. The dichromate method is easy to apply and the end point is sufficiently sharp, and hence we prefer this method.

Saline soils frequently occur in semi-arid and arid regions of our country. The estimation of total soluble salts, which impart salinity to soils, should form an important part of any pedological studies especially in dry areas. There is hardly any mention of this aspect of soils in CORNWALL's book. The total soluble salts could be estimated by studying the electrical conductivity of an acqueous extract of soils. This type of information is valuable for knowing the drainage pattern and also climatic conditions.

We have applied these methods to the study of lateritic soils, river deposits, fossil soils, and black soils from various parts of India and we shall now briefly review the results obtained by us along with a good deal of work by other scholars.

KOESTER (1964) has studied the laterite profiles from Kot and Pedhamli from north Gujarat. In these investigations he has employed Mechanical analysis and Microscopic methods including phase contrast and immersion methods. Even though normal chemical and petrological methods are generally useful in understanding the lateritic profile, they do not tell us much about the mode of origin of laterites. As most of the essential minerals and new minerals formed as a result of weathering are of sub-microscopic size, normal petrological investigations fail in the study of laterites. Generally, mature laterite profiles are rare even in areas where there is thick (10 to 20 m.) covering of lateritic crust over an extensive plateau. In areas like Gujarat where laterite occurs only in patches, the study of its genesis becomes more difficult and recourse has to be made to be the advanced methods mentioned above. KOESTER has proved that the laterites have formed *in situ* from granite (Kot area) and from sandstones (Pedhamli area). In the case of granites, felspar, biotite and hornblend and in the case of sandstones muscovite have been kaolinised. Source of the iron in these profiles is from ferro-magnesium minerals of granite and from haematite rich bands of sandstones. Movement of iron solutions in upper direction, formation of iron concretions at the surface and the leaching of silica have been excellently proved by KOESTER with the help of these advanced techniques. These investigations have also shown that the end-product of

laterite formation is by no means stable. In addition, for fuller understanding of laterites geomorphological conditions of the area must also be taken into consideration. Recent researches by KING, (1962; 169–177), have shown that the tropical climate is not essential for the formation of laterites. They are forming now in many regions, some of them characterised by strongly contrasted seasons, and some by wholly humid and temperate climates. Thick formation of laterites over a pediment surface requires about half a million years. Laterites seem to have started forming on the older tertiary pediplaned land surfaces and the process is still continuing.

Gravels are the principal toolbearing horizons in India and hence their study has taken the prime place in prehistoric archaeology. So far, they have been only vaguely described and interpreted. Whether the gravel or silt was laid down in comparatively dry or wet phase during the Pleistocene is a question which still remains to be finally answered. Unless quantitative studies of geology, geomorphology and sedimentology (which generally includes the study of size, shape, degree of roundness, composition, bedding and orientation of pebbles etc.) are carried out in various river basins of Peninsular India we are not likely to get a correct picture of depositional environments of Pleistocene period. Morphometric gravel analysis have enabled BUTZER (1963) "to derive information about accurate quantitative description of sediments, comparative analysis of differences in precipitation effectiveness (this can be obtained by the study of fossil gravels of various ages as opposed to modern bed material of any catchment basin locality), and differentiation of fluviatile, colluvial or slope components within individual beds or the identification of the dominant transport agent responsible for questionable sediments." Our experience has shown that generally the coarse pebbly gravel occurs in upstream areas and there it does not differ much from modern bed materials. In such areas the pebbles are bimodal in composition, less sorted, many times immature and loosely cemented in clays or sand and calcareous material. This is visible in upstream areas of Mula-Mutha, Krishna, and Rallakalava (the last in Dist. Chittoor, A. P.). Sometimes the gravels are mature, very well cemented and do not in any way compare with the modern bed materials which are generally sandy or silty. We get such evidence in Middle and Lower Narmada, Sabarmati, Arni near Vadamadurai, etc. In such cases, they may be of great palaeo-climatic significance. However, without fuller treatment of the geology and geomorphology of the area, any conclusions drawn are likely to be misleading, e. g. bouldery gravel in Attirampakkam area may not necessarily have been laid down only by the great Pallar river but it might have been formed to some extent at least by mass wasting processes.

Further, in majority of cases, Middle Stone Age tool bearing gravels especially in the Narmada and the Pravara are finer in size, more rich in siliceous materials, and cross-bedded. A statistical treatment of these sandy cross-bedded deposits may throw considerable light on the environmental condition of the Upper Pleistocene period in these river valleys.

Silts are generally in the shades of brown, red, and yellow colours. Kankarisation appears in the form of nodules, concretions, veins and bedded crusts and

many times they form honeycomb structures. Mottling is also common. Pockets of fine sandy lenses and laminated bands of silts of different colours are also not uncommon. In a majority of cases these silts are devoid of tools and fossils and there is loss of stratification due to secondary processes and they assume many times the loessic characters. Normal methods of the soil analysis have been found to be quite useful for the study of these silts but sometimes mechanical analysis fails to distinguish amongst the wind-borne silt, wind-borne silt redeposited by streams, and silts deposited by streams. In addition, colours of silts, detection of fossil soil horizons, greasiness and mottling of silts and their genesis are some of the factors that require careful investigation.

Most of the expectations regarding the knowledge of past environments are fulfilled by the application of the methods mentioned hitherto and a fairly good picture of the environments could be reconstructed at Nevasa, Sabarmati, Narmada, Langhnaj, Birbhanpur and Tinnevelly.

Two fossil soils are encountered in the Nevasa excavation profile. The first one, the so-called weathered black layer, corresponds chronologically to a time gap between the Chalcolithic and Satavahana periods, while the so-called virgin black layer forms the base on which the Chalcolithic people came and settled. Our pedological investigations have revealed that the so-called weathered black layer shows definite soil characteristics and it has been formed by the weathering of the habitational deposits of Chalcolithic period. This indicates that the place was deserted by Chalcolithic people due to some calamity and a considerable period must have elapsed to allow for the growth of vegetation and the formation of soil on the top portion of the habitational deposit. The chemical and physical analyses indicate that the soil formed here belongs to the brown soil group and as such comparatively drier climatic conditions must have prevailed wit h an annual rainfall of about 50 cm. accompanied by hot summers and corresponding scrub-forest type of vegetation growing in the locality. The so-called virgin black layer similarly appears to have been formed by the weathering of the yellow silt deposited by the river Pravara. Here the climatic conditions must have been more moist and less hot, which have resulted in the formation of the chestnut brown soil, with the rainfall of the order of about 62 to 75 cm. per annum. Vegetation typical of chestnut brown soils (Mostly steppy grass) must have grown. Similarly, a long time appears necessary for the formation of this vigin black soil, which is definitely more mature than the weathered black soil. It is probably for the first time that the chronological gap existing between the Chalcolithic and early historic periods in Maharashtra has been explained on the basis of soil formation studies.

At Langhnaj the immature buried soil has been formed from the weathering of light yellowish brown calcareous sand and this was probably an ancient land surface over which microlithic man in Gujarat lived. The presence of this buried soil has indicated slightly damper conditions (ZEUNER, 1950; 6), than those obtaining before and after this period with a cover of vegetation sufficiently dense to increase humus content in the soil. On this ancient land surface, along with

other cultural remains of microlithic man, bones of rhinocerous (*Rhinoceras unicornis L.*) were found. From the detailed palaeontological study, especially that of its skull, the species has been shown to be a dweller in jungles. As Langhnaj is characterised by low rainfall area, the presence of jungle-living rhinocerous in microlithic times posed a problem. Here on the basis of a faint fossil soil horizon, (ZEUNER 1963, 22) has suggested "that the country was dry and open at Langhnaj, whilst river valleys and nallas contained a dense reed jungle suitable for this animal." However, in our visit to Langhnaj we could not visually detect any fossil soil horizon in that area. In his recent excavations at that place. KENNEDY also could not see any fossil soil. However, a very close sampling followed by micromorphologi- al and detailed chemical investigation may prove the presence of buried soil in this area. Due to the sandy character and consequent higher permeability of strata and low colonisation of organisms biologically less active, the soil characters may not be visually very clear in this area.

At Sabarmati and Mahi, the fossil red soils have been formed on the fluviatile sand and silt and are overlain by fluvial and eolian sediments. The fossil red soil suggests a rainfall of the order of 50 to 100 cm. in a climate with a long dry season and with a dry forest during the Upper Pleistocene times (ZEUNER, 1950; 10).

Recently, WAINWRIGHT (1964) and HEGDE have jointly worked out three fossil soils from lower Narmada near Broach. On the basis of micromorphological, physical and chemical investigations, these soils have been proved to be of Braunlehm type and probably indicate the same type of climate as was shown by ZEUNER at Sabarmati. These three fossil soils have also been correlated with the lowering of sea level during the minor stadial phases of Wurm period.

B. B. LAL, (1961, 37–45) has made a geochronological and environmental study of the microlithic sites at Birbhanpur with the help of various physical and chemical methods. On the basis of the study of weathering of hornblende in various excavated layers he has assigned a very high antiquity to the microlithic industry.

Tinnevelly is another area of microlithic sites where pedological investigations have been carried out by ZEUNER (1956) and Rotlehm type of red soil has been shown to have formed on dune sands. Further, on the basis of this study, the site has been dated to around 4,000 B. C.

The modern black soils are found to occur commonly on basic rocks. Wherever it has formed on alluvium, the alluvium is predominantly basic in character, low in quartz, and slowly permeable on weathering. They are generally low in organic matter and many times rich in clay contents. RAYCHAUDHURI (1963) attributes black colour of soil to clay-humus complex and not to organic matter alone while many of the earlier workers have attributed the blackness to the richness of organic matter. As the black soils have very important place in the study of post-glacial or early Holocene climate in India, its thorough investigation with the help of modern methods of analysis is necessary.

K. T. M. HEGDE :

I am putting before you the results of our soil studies carried out at the University of Baroda.

As has been indicated by B. B. LAL, the pioneering geochronological studies on the Indian Pleistocene deposits were carried out by ZEUNER. We have recently tried to extend these studies to the lower Narmada and have brought to light three fossil soil horizons, in the course of our survey of the Pleistocene formations in this river from Chandod to the Gulf of Cambay, a stretch of 104 kilometres. Samples were collected from different sites from the modern soil as well as from the Pleistocene formations.

It is difficult to evaluate the climate of coastal Gujarat. The total amount of rainfall to-day in this region differs considerably from place to place. The lower Narmada receives an average annual rainfall between 150 cms. to 175 cms. A hundred miles to the north, the average annual rainfall is around 75 cms. On the lower Narmada, almost the entire precipitation falls during the period between June and September, the rest of the year being practically dry. The effect of so much rainfall in so short a period of time has to be taken into account while studying the Pleistocene deposits in the region. Besides, the intense, prolonged dry period from October to May is also of equal importance, particularly for understanding certain typical soil formation processes in this region. The intensity of weathering under these circumstances is very high. The prevalence of high temperature hastens the decomposition of soil organic matter. (CARLITT, 1935).

This problem of the survival of the organic matter in the tropical soils has an important bearing in the case of the samples investigated from the lower Narmada. In the case of the Pleistocene soils there was little or no organic matter present. The case of the modern black cotton soil was however, different. Humus was present all through its profile and was found to be concentrated in A_1 horizon and in B horizon. The concentration of humus in B horizon indicates a degree of maturity in this soil, although, the time needed for this maturity, with the date at our command, could at best be a guess. It is quite probable that this soil is of considerable antiquity and was formed under the influence of a protective vegetation cover which has since disappeared. ZEUNER (1950) has also suggested that this soil was formed under the influence of a woody vegetation. In the Western Ghats-region, the humus-rich black soil was studied by GAUSSEN, LEGRIS and VIART (1961). They have attributed the presence of humus to grass land and forest conditions.

It is, therefore-clear that the vegetational scene in Gujarat was different a few hundred years ago. Subsequent deforestation and intensive agriculture has brought about the present-day semi-arid conditions. The dry loose top soil in the cultivated areas is either removed by the first monsoon rains or is blown off by dust storms in summer owing to lack of vegetation cover. This soil is getting rapidly erroded. The upper thin crust in any soil is the most important part for sustaining plant life.

On the lower Narmada cotton is grown upto the edge of the river section. It was difficult to obtain a complete original soil profile for analytical studies. Under these conditions it was not possible to determine the vegetation that was responsible for the formation of this soil. Agriculture has heavily modified the original vegetational cover of this soil.

We are still looking forward to a spot with such soil undisturbed by modern agriculture, because of the association of this soil with certain of our prehistoric settlements.

Below the modern soil, we have three fossil soil horizons.

Soil I.

This is the highest and the most recent of the three fossil soils. It makes its first appearance about half a mile upstream from Nikora at which point its surface was found to be 20 m. above the water level. It is 35 cms. thick and is a clearly visible feature in the cliff. The samples of this soil were collected for analysis from Nikora and were examined for PH., Carbonate, Humus, iron, phosphate and manganese. These tests were sufficient to indicate the nature of chemical weathering of the soil. The micro-morphological study of the soil indicated a dense fabric, root-holes and that it is a kind of soil that can be compared to tropical *Braunlehm* (German = brown loam) described by KUBIENA (1953). *Braunlehm* is properly the soil of a humid-tropical environment where the iron oxide is not dehydrated. Hence the soil will not get reddened. Unfortunately, there were no pollen grains preserved in the soil. Pollen analysis was carried out on all the three fossil soils by GUINET of the Palynology Laboratory of the Institute Francais, Pondicherry.

Soil II.

Soil II first appears at Angareshwar at a height of 17·5 m. above the water level and thereafter it is a consistent feature of the cliff downstream upto Tawara. Further downstream from Tawara, the cliffs are eroded and the fossil soils I and II cannot be traced.

Soil II is visible in the section as a weak brown weathered horizon with shrinkage cracks. It is 45 cm. to 60 cm. thick. The samples of this soil were collected from Angareshwar where it was first recognised and from Nikora where it is stratified between soil I and III. The samples were subjected to chemical, mechanical and micro-morphological studies. This was also found to be similar to tropical *Braunlehm*.

Soil III.

From Ambali to Bharbhut, a red weathered horizon as thick as 38 cm. can be easily identified overlying the sands and silts of the lower series which form the parent material of this soil. This soil is throughout a prominent feature on the section and is marked by consistency and compactness, and red-brown colour.

A mechanical analysis of a sample of this soil, collected from Angareshwar indicated that it is composed of 10% sand, 86% silt and 4% clay. Thus, the material of this soil is predominantly silt. It is, therefore, loessic in character and is indicative of arid conditions when it was under formation. Its weathering indicate subsequent wet climatic conditions.

The chemical and micro-morphological studies of the soil indicated that it was very intensively weathered, much more than soil I or II. There was considerable leaching of carbonate and iron from the A horizon and the iron oxide had dehydrated indicating a transition in this soil from *Braunlehm* type to *Rotlem* (German = Red loam).

Like *Braunlehm*, *Rotlem* is also a humid tropical soil, with the difference of its characteristic colour, due to dehydrated iron oxide. This is produced in prolonged dry seasons alternating with the west.

S. P. Gupta :

The material from the latest terrace of the *teris*, was examined by me and I found that it was not completely water-borne. Pitted surface on many of the quartz grains indicates that the material was brought here equally by wind action. The sample from the next higher terrace at the 26th mile was labeled as 'Lateritic' in the Institute of Archaeology, London. After making sections of the soil and examining them under a microscope, I found that the quartz grains are angular and present all over. There was hardly any evidence to show that there was leaching of silica and concentration of iron. The redness in the soil was due only to the weathering of iron-producing minerals present in the sand that formed the terrace.

However, the mechanical analysis of the samples from these two terraces showed that the 'S' curve in the case of the former was extremely steep showing the percentage of sand upto about 97, while the curve from the latter had a gentle slope towards the left at the bottom indicating larger amount of silt. To some extent it does indicate a longer weathering process for the material from the terrace at 26th mile. We cannot be more precise than this.

Incidently, I would like Lal to throw some light on the formation of the so-called second gravel and yellowish silt on the river Mutha examined by us yesterday. At least Mrs. Karve feels that it may be a purely local phenomenon and the yellow silt may be the same as the red silt since there are many streaks of red silt present in the yellow silt. It may even be extremely recent in time.

NOTES

1. These samples were collected by the late Prof. F. E. Zeuner in 1949 and handed over to Prof. Koester of Goettingen University, West Germany for further investigation.

2. The field survey was done by Dr. Wainwright, Shri S. C. Malik and the author. Processing of the samples in the Laboratory was carried out by Dr. Wainwright and the author.

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ARCHAEOLOGY AND EDUCATION

H. D. SANKALIA :

Every one is proud of possessing something old, however trivial it be. This feeling is much more acute in countries which are comparatively young. I have yet to see an American who does not take back with him a bronze or a miniature painting from India, because, as he would tell you, his country has nothing very old. To satisfy this vanity even well-known writers use such titles as "5000 years of Pakistan", when this name of the country was barely five years old. The same tendency is being witnessed in newly emerging States of India. Archaeology has thus been instrumental in reviving and nourishing national sentiment—the most outstanding examples being the small countries of Central and Eastern Europe, Iraq and nearer home first Japan and then China. Both in quality and quantity, splendid work is being done and the museums born out of this scientific pursuit of the past have been described as veritable shrines.

But archaeology does not exist solely to satisfy one's pride or the pride of any country in its antiquity. For as in Nazi Germany, it can be grievously misused.

Archaeology is a major source of history, particularly so when no written accounts, legends, or traditions are available to know the past history of a place or a country. Not only the history of new continents like America and Australia, but even of the ancient ones like Asia, Africa and Europe, is being recovered with the help of archaeology.

It is however felt in many quarters, particularly by the persons at the helm, in the newly formed States in India, that the money spent on archaeology—in preserving old monuments and discovering new ones—is a waste. "Why disturb the dead, let sleeping dogs lie. When funds are not enough to meet the needs of the living, why spend on the dead?"

Thus we witness, two contradictory tendencies : pride, sometimes misplaced, in things ancient, leading to local, regional and national patriotism; utter disregard or contempt for old things, particularly when it comes to spending money for acquiring or preserving them. Both these attitudes would appear to stem from an incomplete understanding or appreciation of the true role of archaeology in our life and education.

Archaeology today is not a mere collection of old objects. Among several other things, it comprises or includes or is based upon, observation and collection of field data. This may be anything: small or large stone implements, potsherds, coins, beads, shells, rocks, and soils. Now this part of the work can be done even by children in primary schools, the main object being to arouse their curiosity and develop their power of observation and love for thinking. Even in such advanced countries like England this aspect of archaeology was recognized quite late, when Miles Burkitt, that doyen of British prehistorians, became a conuty counsillor and introduced archaeology in school curriculum some 20 years ago.

The next step is to exercise the child's mind. This can be and is done in various ways. One of the ways is to train the sense of perception and the training of the mind to draw logical deductions from the results obtained by the sense of perception. Here, says BURKITT, prehistoric archaeology seems to be particularly useful. And he proves this by giving an example.

"Any child can draw a picture on a piece of paper in red and when it is dry draw another over it in green; and even a C-stream child, one who is of low mental calibre, will realize when it is put to him, that the red picture was painted first *because it is underneath* the green one. And yet surely this is only an application of the geological law of succession on which the whole of geological history is built. A little later the complete law can be demonstrated by getting a layer of gravel, on which is placed a layer of clay, on which is placed a layer of sand, on which is placed a layer of mud. Then with a penholder, all can be stirred up. Once again even the C-stream child will understand that the law of superposition is only true when you add the words 'if the levels have remained undisturbed'. (A child stretches its mind best when it is fascinated by what it is learning, and there are few subjects so fascinating as prehistoric archaeology, dealing as it does with people and with the origins of things".)

The same thing can be tried with pottery. Here one need not confine one's example to prehistoric archaeology. Thousands of broken pieces of pottery (potsherds) belonging to historic as well as to still earlier periods are found at numerous places in India. Children might be taught to reconstruct the complete shapes from amongst these sherds, just as they do a jig-saw puzzle. Anyhow the aim of stimulating the child's mind in piecing together parts of the same object can be achieved. Thus pottery which forms such an important and vital part in the carreer of an archaeologist can be used in a child's education.

Observation and collection of field data have other important aspects as well. Much of today's child-education is confined to the four walls of the school room. The introduction of elementary archaeology in the curriculum would serve a double purpose: create love for outdoor life and appreciation of nature as well as training of the mind. That children can and do enjoy such kind of work I have had first hand experience. They collect with avidity and would show you their collections with indescribable joy and pride. Such a child will understand much better when later at the secondary school stage of his education he or she is taught about the Stone Ages and the Indus Civilization because he/she will be well acquainted with the material in which the whole edifice of prehistory is built up.

At this stage other branches of archaeology—like numismatics and palaeography—can also be profitably introduced. Here not so much as identification of coins or reading of inscriptions is important as the story of the development of the alphabet and coins. I have seen students listening with rapt attention to the life histories of "letters" and "coins". So also accurate but simple accounts of important and beautiful monuments such as the Asoka's Lion Capital, Karla and Elephanta caves, temples and mosques and minerets should form a part of students' curriculum. In fact regular introduction of archaeology in the secondare education will aid the teaching of history and geography. The former will not by

a mere catalogue of names and dates, but something concrete, the past achievements of peoples of different ages. The study of geography—place, region or country—will also take a more realistic shape when there is something to focus their attention on.

In this way the foundation will be laid of an all round knowledge and if such a child later becomes a member of a village panchayat, town council, State legislatures or Parliament, he will realize the importance of archaeology—and much more so if he or she has had the benefit of further education in a college. For here the student is made fully aware of archaeology as one of the important sources of history—whether it be of India or any other part of the world. Simhagadh near Poona, Ellora or Elephanta or, for that matter, the Taj Mahal vivify the past. They are history petrified. The study of such monuments and their conservation is the bounden duty of every citizen. No wonder therefore if India has one of the largest Archaeological Departments in the world, whose main task is conservation of existing monuments of national importance. For its creation we should be thankful to Lord CURZON. However, the same cannot be said of the several States. After re-organization, the monuments in States are in a very sorry plight. Very few of them have enlightened rulers with the result that literally hundreds of monuments and archaeological sites are dying a natural and artificial death before our eyes. With no resources in men and money, the so-called 'Directorates' of archaeology can do little to save them.

While the existing monuments do tell us of our past history, it is the discovery of new ones that reveals our past more and more or deeper and deeper. With written records going back only upto the third century before Christ, India was believed to have no very great past, though her people always thought that she was one of the most ancient countries in the world. But for the discovery of Mohenjodaro, we would have been proved to be wrong in our belief. Now, during the last twenty years, more and more unknown facets of our history are being revealed every year. But still much remains to be done. This can be achieved provided the Centre and the States encourage archaeology on proper lines. For now archaeology is no longer one man's job. Not only have the directors of archaeology and professors in the States and universities to be competent archaeologists, but they should have sufficient knowledge to take the help of the sister disciplines of chemistry, physics, agriculture, botany, climatology and medicine including dentistry. Thus archaeologist has to be a jack of all trades and master of his own subject. Recently American archaeologists "peered through the lenses of some 28 different sciences to learn the ways of the prehistoric cliff dwellers of Mesa Verde in Colarado" (*National Geographic*, Feb. 1964). Imagine what an all round knowledge archaeology gives today! When coupled with it we take its other aspects into consideration viz. the ability to work, often alone, in unknown, uncharted regions, and ability to get things done, that is an adventurous spirit and powers of organization, leadership and resourcefulness, we realize how useful archaeology is in our modern education.

Lastly archaeology paves the way for international goodwill and gives delight that only pure knowledge, or knowledge for the sake of knowledge, can give. This alone explains why as many as 186 expeditions consisting of 500 undergraduate and 120 postgraduate students from British Universities went out to explore and learn in several foreign countries. That is why so many nations of the world have contributed money and experts to rescue the temples of Abu Simbel in Nubia and Egypt and that is why thousands of rupees are being spent by several foreign countries in Egypt, Iran, Greece, Turkey and now in Africa. For the desire is to acquire knowledge, not of this country or that, but of man and the way he has progressed towards civilization.

This world has been divided into two blocks. Their opposing ideologies have pushed the world on to the brink of self-destruction. To escape from this holocaust, it is felt that the only way "is to create a frame of mind, a vivid consciousness of belonging to a world society, transcending, but also comprehending regional and even national loyalties". To enable people "to feel themselves members of a world society one way of helping them to do so is to stimulate a consciousness of world history".

This social integration may be achieved by a study of prehistory, for all countries whether civilized in the modern sense or not, had had to pass through this stage. Realization has been brought to many a nation vaunting a glorious past that all races of mankind had a common biological and cultural ancestry. It is growing interest in our common history that makes us take interest in discoveries of the earliest ancestors of man—about 1·8 million years old—in far off Tanganyika in Africa.

Archaeology, in brief, besides creating national pride in people and countries, if properly cultivated stimulates latent powers of observation and perception in the child, and helps him draw logical deductions therefrom. Further it facilitates the teaching of history by vivid and interesting examples and makes us capable of appreciating art—primitive as well as advanced—and later, intelligently pursued becomes a source of history. Money spent on research is not a waste, for not only it adds to our knowledge but promotes social integration at all levels and thus creates a consciousness of being a citizen of the world.

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